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THE FRANK E. BUNTS INSTITUTE

will present

A Course In

Diseases of the Endocrine Glands

on

MONDAY, TUESDAY, and WEDNESDAY
APRIL 18, 19, and 20, 1938

A description of the course and an outline of the subjects to be covered will be found on pages 147-149.

ABDOMINOPERINEAL RESECTION FOR CARCINOMA OF THE RECTUM

T. E. Jones, M.D.

In its brief span, American Surgery has progressed far and it is fair to assume that it will make further advances. The progress of thoracic surgery during the past 20 years has been amazing. Fifteen years ago we little thought that the two, three, or four stage operation for hyperthyroidism would be transformed into a single stage procedure with a mortality varying from 1 to 2 per cent. This has been accomplished in part by a better knowledge of the disease, but it is due chiefly to better preoperative treatment. Quite analogous to this has been the progress made in surgery of the colon and rectum. We have a better understanding of the pathologic physiology, surgical technic has been tremendously improved, and x-rays have rendered invaluable contributions to the diagnosis of early lesions of the colon, but it is sad to relate that, in spite of all the previous teachings, digital examination of the rectum is still frequently neglected. Coincidentally also, inspection seems to have fallen into disrepute. It has become too easy, perhaps too cheap, to say "Have an x-ray and see what is wrong."

Statistics from any institution will show that 75 per cent of the growths in the colon are within reach of the examining finger or the proctoscope and, as every roentgenologist knows, low-lying lesions are much more difficult to diagnose by means of roentgen examination, so that a negative report is not only misleading but gives the patients a false sense of security which may lead to months of delay. The roentgenologist could save himself many errors and at the same time render a great service to the patient if he would refuse to make roentgen examinations of the colon until he had a report that a digital and proctoscopic examination had been done. The digital and proctoscopic examinations will give infinitely more information regarding a growth in the rectum or the rectosigmoid—that is, information relative to its location, its extent, and its fixation, all of which are necessary from the standpoint of determining operability. So, when a patient presents himself with rectal bleeding, do not be content with a visual inspection of the anus to determine whether there are hemorrhoids, but do a digital examination, and if negative, a proctoscopic examination. You, as well as the patient, will be relieved if a malignancy is not found. Only after this procedure has been carried out should the roentgen examination be done. I know a physician in a community not far from mine who made a reputation years ago because he made the patient take off his coat and vest before he examined his chest with a stethoscope. I am sure that you will be amply rewarded if you make this simple routine of digital and proctoscopic examinations for rectal bleeding. You are also aware of the fact

that at least 10 per cent of patients with malignancies of the rectum have had a hemorroidectomy within the six months preceding admission.

If a lesion is found and you are not certain of its nature, the next question that presents itself is, shall we do a biopsy? That depends entirely upon your experience. In case of any doubt, by all means do a biopsy. I feel that a great deal of harm was done 10 or 12 years ago by those who advocated that cancer would be spread by biopsy. It has always been my opinion that far less harm is done by taking a biopsy than by sitting idly by and watching the cancer grow to such proportions that its margins, elevations, and its craters may even spell the word cancer. Furthermore, a hundred and fifty dollar electrocautery machine is not required to do a biopsy. The scissors, snare, or knife are entirely satisfactory.

The diagnosis having been made and the procedure decided upon, the patient should be told that he has a serious complaint and needs immediate surgical attention. I do not think it is fair to minimize the complaint for fear of shocking the patient. To be sure, each patient must be handled somewhat differently. If the patient asks the pointed question, "Do I have cancer?", I tell him the truth. I have never yet to regret it, for then I can use all my ammunition and before I am through I have a cooperative patient. If the patient evades the question, I do the same, provided he is willing to accept the advice. If he is reluctant, then I think it is our duty to inform him further. I have seen too many of these patients delay operation for months because, just to save his feelings, the doctor told him he had a little ulcer. Naturally, the patient does not see why he needs to have a major operation for a little ulcer, so he tries some medicine for a while and, even in this enlightened age, many doctors give medicine for such a lesion.

It is appropriate to speak of gradation of tumors because, when the biopsy diagnosis of carcinoma comes back, the pathologist will usually have made a notation, grade 1, 2, 3, or 4. Grade 1 is supposed to be a good cancer, grade 4 a bad cancer. Word seems to have gotten around that cancers of grades 1 and 2 are to be attacked, but that it is not good cricket to attack grades 3 and 4—these should be relegated either to x-ray or some other nonsurgical treatment. With this opinion, I wholeheartedly disagree. I am in sympathy with everything that increases our knowledge relative to cancer and I think that grading of tumors is an excellent thing from an academic standpoint, but I am distinctly opposed to guiding therapeutic effort merely on a pathologist's statement that this is grade so and so. This is a misconception that I do not blame the pathologist for entirely. He has, to be sure, painted a black picture of grades 3 and 4 and, unfortunately, many surgeons are glad to hide under that cloak and shirk responsibility, but we must remember that grada-

tion of tumors is far from a perfect science. However, it is something that may help the surgeon formulate a prognosis—not before the rectum is removed, but afterward. We have an obligation to relieve, if possible, as well as the obligation to cure. At the present time, clinical judgment surpasses any laboratory test so far as the decision of treatment is concerned. The shortcomings of the grading of tumors as a criterion for the treatment to be used are too numerous to mention here. If a cancer of the rectum is clinically operable, operate regardless of whether it is grade 1 or grade 4 and you will be doing the best thing for your patient.

The treatment having been decided upon, the patient should be encouraged to enter the hospital as soon as possible. Here further investigations should be carried out and on the thoroughness of these examinations and adequate preoperative care depend the success of the operation. A careful physical examination is essential. Studies of blood chemistry and tests of kidney function are important in order to ascertain the risks. In all men over 55 years of age, if they have any urinary disturbance whatsoever, a cystoscopic examination is necessary because of the possibility of associated prostatic hypertrophy which may prove disastrous if not recognized. On account of the location of the tumor and the associated nerve supply, it must not be taken for granted that bladder disturbance is due to pressure or irritation of the tumor. In many of our patients, it has been necessary to do a resection of the prostate either before or after resection of the rectum.

During the stay in the hospital, a high calorie, nonresidue diet is given. Glucose intravenously is administered to build up the glycogen reserve of the liver because many of the patients have been dieting for some time on account of bowel disturbance, the chief symptom of which has been diarrhea. This is not a true diarrhea, however; rather, it is the frequent emission of pus, mucus, and blood from the ulcerated area—as a matter of fact, in most cases of so-called diarrhea, the colon is filled with hard, dry feces and many days are required to empty it. For this purpose we give one ounce of magnesium sulphate daily in divided doses together with daily enemas for 5 or 6 days prior to operation. By this measure, we feel that we can decompress the bowel in all cases of chronic obstruction just as well as by preliminary colostomy.

In the preoperative treatment, the question of intraperitoneal vaccine naturally comes under discussion. I have never been impressed with its value when dealing with cancer of the rectum and rectosigmoid because peritonitis as a cause of death has played a minor rôle in our series. To inject vaccine routinely in a large number of cases, seems to me an unwarranted procedure. It must be remembered that the use of vaccine does not, by any means, eliminate peritonitis. It has been reported to

lower the incidence. Meticulous technic is still far more important than intraperitoneal vaccine in its present form.

Operations for carcinoma in the various segments of the colon have been fairly well standardized but not so far as the rectum and rectosigmoid are concerned. The chief reason for this is the controversy over the undesirability of the colostomy. Posterior resection with perineal anus still has its supporters and many different varieties of operations have been designed. Now other types of segmental resection are being tried anew. However, one has only to look over the records of older, just as able surgeons, and from them these facts are learned—viz., that the operability was low, the mortality high, and the curability rate low. Such is the story from smaller operations or operations devised to save the sphincter. I am not one who believes in the statement handed down from textbook to textbook that cancer of the rectum is different from cancer elsewhere, that it tends to remain localized for long periods of time, and that glandular involvement occurs late. If that were true, why has the curability rate been so miserably low?

Cancer of the rectum and rectosigmoid demands just as radical a procedure as does cancer of the breast if we are to improve our curability rate—and radicalism from the standpoint of the rectum is best attained by the combined abdominoperineal operation which was described by Miles of London and which should bear his name, regardless of a few variations in technic by different operators.

This operation may be done in one or two stages and a surgeon must use that with which he is most familiar and which is best suited to the available facilities at his command. The name "two-stage" obviously carries with it the implication of the factor of safety but this does not necessarily follow. We must remember that when two major procedures are performed on persons in this age group, the hazards of accidental deaths are increased beyond our control by two times. Emboli, pneumonia, and unexplained sudden death are a source of annoyance to all of us.

Then again, many things may happen during the first stage which may delay the second operation for a long time or may give rise to complications which may lead to abandonment of the second stage, such as pneumonia with empyema, severe infection of the abdominal wall, phlebitis, pyelitis, suppuration, parotitis, so that even the two stage is not entirely uneventful. Of course, these complications in some form occur in 10 per cent of cases of the one stage but at least these patients do not have to face another major procedure. In addition, technical difficulties are encountered in the second stage which do not pertain to the one stage. Finally, the combined mortalities from the first and second stage will be

as great or greater than from the one stage. For these many reasons, I personally have favored the one stage procedure because, in a series of over 250 cases, the mortality has been under 10 per cent.

After preoperative preparation which averages about 7 days and to which I attribute no little amount of success, anesthesia is the next thing of importance to consider.

I still favor spinal anesthesia because it affords more relaxation and a quiet abdomen which lends itself to a more rapid performance of the operation. After completion of the spinal anesthesia, a catheter is placed in the bladder and, during the emptying, constant pressure is maintained over the suprapubic area and as soon as the urine has stopped running, the catheter is corked. Otherwise, air will rush into the relaxed bladder and will be as troublesome as a bladder full of urine.

The deep Trendelenberg position is invaluable on account of the deep pelvic dissection which is necessary. The abdominal part of the operation consists of about nine simple, straightforward maneuvers which, if carried out methodically, simplify an otherwise laborious, time-consuming task. The perineal part of the operation is expeditiously done, provided the abdominal dissection has been thorough; otherwise, it likewise will be too time-consuming. The details of these various steps have been described previously.

Blood transfusion is a routine procedure either before or after operation, sometimes before and after, depending upon the condition of the patient. Postoperative treatment is symptomatic.

The colostomy is opened on the second or third postoperative day, depending upon the distension and pain the patient has. The wound is protected with vaseline gauze over which rubber tissue is placed. I feel that infected wounds occur at the time of operation and are not caused by early opening of the colostomy, provided ordinary care is exercised. About 10 days after operation, the colostomy is trimmed down to about one-quarter of an inch above the level of the skin so that the healed wound is just about at the skin level or slightly above.

In the last 200 cases, we have been bringing the colostomy out at the midline and have found it infinitely better from many standpoints. First, it saves time during the operative procedure; secondly, if a colostomy bag is worn, the patient looks symmetrical and not lopsided as is the case with the inguinal colostomy. This is very important in the care of the woman patient. Again, if an inguinal colostomy is used and the patient wears a colostomy bag, it generally rubs the crest of the ilium which leads to irritation and also leakage in case of accident due to improper fitting.

The care of the bladder is very important in these cases. Since extensive pelvic dissection is required, many sympathetic nerve fibers which innervate the bladder are destroyed and about 75 per cent of the patients will have some disturbance of the bladder for a month or two. Formerly, we used a retention catheter for six or seven days but we have abandoned this. Experience has taught us that it is better to catheterize the bladder three or four times a day, and this has led to fewer complications. From 25 to 30 per cent of the patients will void spontaneously and cystitis will be avoided in at least this number, whereas it might have been contracted had a retention catheter been left in place. In only one instance have we had permanent damage to the bladder and that occurred in a case where it was necessary to remove part of the prostate due to fixation. Probably the sphincter itself was interfered with here. Urinary antiseptics and frequent irrigations are used to treat the infected bladder.

The rubber dam and gauze pack employed to support the new pelvic floor and prevent oozing after the operation are removed partly on the second, third, and fourth postoperative days, after which the cavity is irrigated with saline solution or sterile water until most of the discharge has subsided. After this, it is merely swabbed out with cotton pledgets. This is a simple procedure which is taught to some member of the family when the patient is discharged, for 10 to 12 weeks are required for this posterior wound to fill in.

In a normal convalescence, the patient is allowed out of bed in 12 to 14 days. This permits the new peritoneal pelvic floor to sag a little and thereby hastens the obliteration of this large cavity.

The performance of a successful operation does not mean, however, that the surgeon's obligation has been fulfilled. He has another duty, a most important one, and one which is often neglected. He must take time to instruct the patient regarding the care of the colostomy and on this instruction depends the happiness of the patient. The usual instruction is to tell the patient to go to a surgical supply house and buy a colostomy bag. That is a sure way to make him a social outcast. The odor from the rubber is far worse than the odor of the stool. Personally, in my preliminary instruction, I do not even mention that there is such a thing as a colostomy bag. The patient is taught to irrigate the colostomy himself, not to have some member of the family do it because this is always embarrassing to the patient. Many good types of apparatus are on the market, the only objection to them being the cost. All that is necessary is the ordinary enema apparatus, with a little rubber disk on the enema tip which, when placed tightly against the colostomy, will make it water tight.

Experience has taught us that daily irrigations are too frequent. The colon will be kept too clean and soon the patient will complain that he cannot get his bowels to move. We have found it best to irrigate every second day and in a few months, if this routine is carried out at the same time, the bowel will become practically an automaton.

Accidents between irrigations rarely occur and patients wear only a small pad under an abdominal binder suited to their individual tastes. Our instructions and demonstrations regarding the care of the colostomy are more time-consuming than the performance of the operation itself.

I have never been impressed with the desirability of giving the patient a constipating diet. Such a diet may cause diarrhea in another patient, so I tell them to follow the diet they have been accustomed to and eliminate from time to time such things as disagree with them.

The question of postoperative radiation is always a pertinent one. My own feeling is that if the proper operation has been performed, there will be nothing left in the pelvis except small intestines and I do not think it is a good policy to radiate them routinely, except when there are demonstrable glands on the lateral pelvic wall.

In this group, we have operated on patients in an age range from 26 to 74 years. Five per cent of our patients have been 70 or over, and the mortality in this group is the same relatively as in the other age groups. Age alone is not a contraindication to operation. Many patients at 70 are better risks than some at 60, but I do think that good kidney function is essential in patients over 70. Hypertension, arteriosclerosis, diabetes, and obesity have not deterred us from the performance of this operation.

Palliative operations are essential in a certain group of inoperable cases. We have seen patients not benefited a great deal by colostomy and it is important to study these carefully and make a distinction between the pain of obstruction and the pain of metastasis. Routine colostomy in the latter group will only add to the patient's misery and, in my estimation, is contraindicated unless there is obstruction. Colostomy to a well man is but little trouble, but to a bedridden, hopelessly ill individual, it is very disagreeable.

Operability percentage is always of great interest and, with this in mind, I reviewed one hundred consecutive cases of cancer of the rectum as the patients presented themselves for examination beginning July 1, 1937, and going back until 100 consecutive cases had been reviewed.

The following figures are quite informative and give one a comprehensive picture of what happens in a definite group.

Total cases		100	
Did not return		10	
		90	
Inoperable, no treatment	9		
Inoperable, palliative	11	20	
Explored		70	— 77%
Inoperable, liver	10		
Inoperable, local fixation	3	13	
		57	
Combined one stage	54		
Other operations	3	57	

Deaths, 4 — 7.2 per cent

Operability — 63 per cent

Mortality, 4 — 7.2 per cent

2 peritonitis

1 embolus

1 pneumonia

THE TREATMENT OF CONGENITAL CLUB FEET

JAMES I. KENDRICK, M.D.

In this discussion no attempt will be made to present a review of all the aspects of the treatment of congenital club feet, but treatment of the early cases will be discussed and a method described for correction of this deformity.

Early diagnosis and prompt initiation of treatment are essential. Although the foot of an infant does not have the contour of that of an older child, very mild elements of deformity can easily be recognized by close examination and by putting the foot through ranges of motion, both actively and passively. Active movements of the foot of an infant can be observed very easily by gently stroking the inner and plantar aspects. The foot will be drawn away from the stimulus and the active range of eversion and dorsiflexion can be estimated. The foot of the normal infant is quite flexible and can be put through wide ranges of motion both actively and passively.

If treatment is begun early while the foot is flexible and composed mainly of cartilage, at least 95 per cent of the cases can be corrected by manipulations and molding alone, and if the foot is held in the corrected position for a sufficiently long period of time, cure can be effected. The logical time to start treatment is that period between birth and the time the child begins to walk. Weight bearing in the corrected position tends to maintain correction and promote normal growth. Weight bearing in the uncorrected position increases the deformity and stiffens the foot, making all later attempts at correction more difficult and the foot less serviceable after correction. Gentle manipulations and gradual molding of the deformed foot undoubtedly cause less reaction and result in a more flexible and better shaped foot than can be obtained by forceful manipulations under anesthesia.

Each club foot presents a separate problem. The degree of the elements of deformity are rarely the same even in each foot of the bilateral case. One may show only a mild degree of adduction of the forefoot (Fig. 1), another only inversion and shortening of the heel cord, while still another may show all three of these elements of deformity (Fig. 3A). These variations make me feel that treatment should be instituted only after the very closest examination and with the degree of each element of the deformity kept well in mind.

Kite[1] has discussed the advantages of the gradual correction of club feet and it is the wedging cast which he described that I have used and found to be very effective. He pointed out the necessity of correcting in succession each element of the deformity. I have found this to be most important. The adduction of the forefoot should be corrected first

and the relation between the navicular bone and the head of the astragalus restored before correcting the inversion and equinus. After the deformity in the forefoot has been corrected, the foot may be blocked into eversion and last into dorsiflexion. The normal relations of the bones should be restored and too great a degree of overcorrection should be avoided. Unless such care is taken, a very severe club foot may be enthusiastically blocked into a marked degree of overcorrection and, if held in that position for a sufficient length of time, may result in a badly pronated foot—a foot which would be better in appearance but almost as disabling as the original deformity.

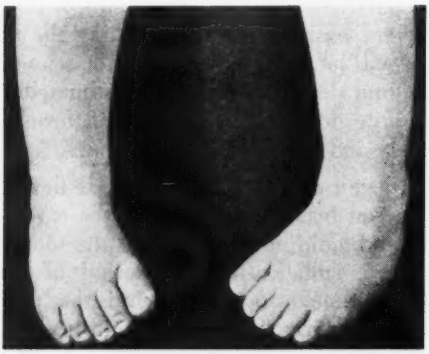


FIGURE 1 shows the case of an infant whose treatment was begun at the age of ten months. The prominent element of the deformity was adduction of the forefoot. The correction by molding in wedging plasters required ten weeks. Walking casts were then applied and the youngster learned to walk in these plasters.

There is undoubtedly a great tendency for deformity to recur but, as Kite[2] has pointed out, this tendency is more apt to be present in the cases in which attention has not been given to the accurate correction of each element of the deformity. When correction has been accurate and complete and when the corrected position has been maintained for a sufficiently long period of time, this tendency for recurrence of the deformity is minimized. To maintain the corrected position for a period of several months is no great problem in the infant but, in the case of the child that has learned to walk or has the desire to learn, it is difficult to keep him off his casts. For these older children, metal stirrups with a tread sole have been attached to the casts and they have been permitted to walk as soon as the corrected position has been obtained. To render these children ambulatory simplifies their care so materially that the casts can be left on for the desired length of time without the usual complaints from the parents. I feel that walking on the corrected foot, when it is held in place so accurately, helps to prevent the atrophy

of the muscles which is seen frequently, to promote flexibility of the foot, and to bring about a morphological adaptation to the corrected position.

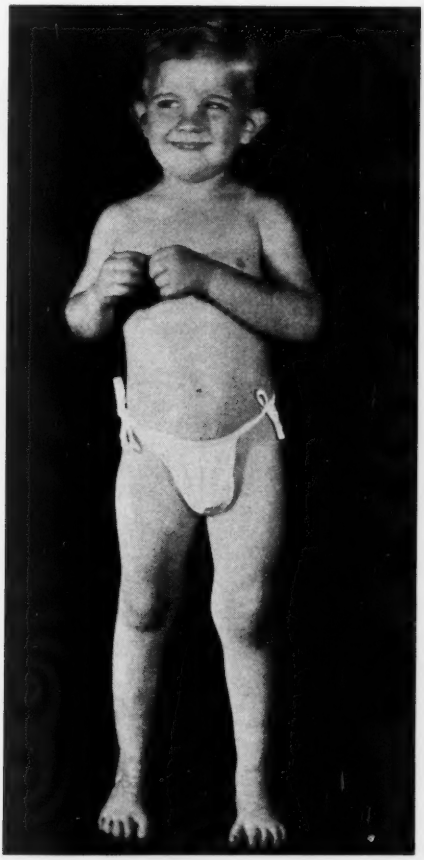
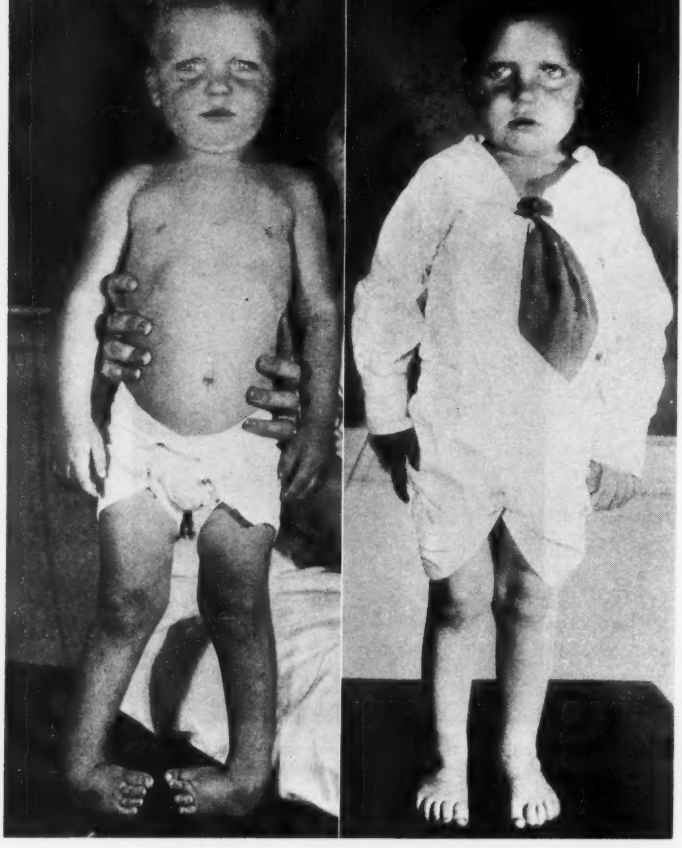


FIGURE 2 shows the child at the age of three years, twenty months after the removal of his plasters. The feet are quite flexible and actively over-correct in all the elements of the deformity.

In the very young infant, the mother is taught to carry out gentle manual manipulations. The sequence of these manipulations follows the same procedure as is used in correcting the foot in plaster. First the forefoot is manipulated to correct adduction, then the inversion is overcome and, last, the heel cord is stretched. The manual manipulations are directed toward keeping the foot flexible, as only in the mild cases are they effective in correcting the deformity. When the eighth

to twelfth week has been reached, the foot is of sufficient size to begin correction in plaster. I feel that the foot should be of sufficient size that the wedges can be accurately removed from the casts.

In applying the wedging casts great care must be taken because, if the casts do not fit well, the wedging cannot be done as effectively and, unless



A B

FIGURE 3: "A" shows an infant whose treatment was begun at the age of eleven months. Correction was obtained by molding in wedging plasters. Four months were required to obtain the correction. The walking plasters were applied and the child learned to walk in these plasters. The plasters were worn for a period of three months.

"B" shows the child at the age of three and one-half years, approximately twenty-two months after removal of the plasters. The feet are flexible and actively over-correct in all elements of the deformity.

properly applied, irritation of the skin and areas of pressure may result. It is essential that a capable assistant hold the foot while the plaster is applied. The plaster is applied over a stockinette only, except over the dorsum of the foot and ankle where the wedge is to be removed. In these areas, half thickness felt is placed between the stockinette and plaster. The casts are wedged twice each week and are used as long as they are considered effective. During the period of correction the plasters are always carried above the knee, maintaining that joint in a position of ninety degrees flexion. This prevents the casts from slipping and also protects the ligaments of the knee joints against stretching as the correction progresses. I have found a small saw to be best in removing the wedges. If an assistant is to remove the wedge, the cast should be marked by the one directing the treatment so that the sequence of correcting the various elements of the deformity may be followed.

At the time of changing the casts, I do not believe that washing the feet with soap and water is advisable as this procedure makes the skin more susceptible to irritation. If the feet are powdered well at the time of changing the casts, plaster may be applied over a period of months without the least danger of irritation of the skin.

After correction has been completed and the corrected position has been maintained for a period of three to four months, the casts are removed and wedged shoes are fitted. It is my feeling that wedged shoes are all that are necessary to maintain correction if the foot has been completely corrected and held in correction for a sufficient length of time. If correction has not been complete, I have found braces ineffective in holding or further correcting the foot.

Figures 1, 2, 3A, and 3B show two typical cases and the end results.

In summarizing, I should like to emphasize the following points:

1. Congenital club feet should be treated early.

2. Gradual molding is the most effective method for correcting the deformity.

3. Maintenance of the corrected position for a prolonged period prevents recurrence of the deformity.

4. The walking plaster boot is of value in the treatment and makes the care of the child much less tedious during the period of maintaining the corrected position.

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VESICOVAGINAL FISTULA

Report of a Case

WILLIAM J. ENGEL, M.D.

The following case is presented not only because it rather typifies the cases of vesicovaginal fistula encountered, but also to report the successful repair of an unusually large vesicovaginal fistula and to call attention to certain measures adopted in the postoperative treatment which we felt were of definite value in the successful outcome of the problem.

The patient was a married housewife, 50 years of age, whose chief complaint was leakage of urine from the vagina. Three years previous to admission, amputation of the cervix had been performed, following which urine did not pass normally but dropped into the vagina. The presence of a vesicovaginal fistula was recognized and during the following year three attempts had been made to close it; two, according to the history, were done by the vaginal route and the third was a suprapubic cystotomy. However, all these operations had been unsuccessful and for two years, urine had been leaking constantly through the vagina, all the urine being passed in that way as the patient was unable to retain any urine in the bladder. The patient had been married for ten years, had had no children, and there had been no pregnancies. The past history was essentially negative and there had been no serious illnesses.

On physical examination, the patient was found to be a well-developed, rather obese woman who weighed 163½ pounds. Her blood pressure was 130 systolic, 80 diastolic. Examination of the head and neck yielded no positive findings and the heart and lungs showed no abnormalities.

On vaginal examination, a considerable quantity of urine was found in the vagina. Examination with a speculum disclosed the presence of a large fistulous opening on the anterior wall of the vagina. This measured about 2 cm. in diameter and through it the mucosa of the bladder could be seen. The fistula easily admitted the gloved index finger and was surrounded by considerable, rather inelastic, scar tissue. The urethra was catheterized and found to be intact.

The essential laboratory data showed 4,100,000 red blood cells, 6,650 white blood cells, and 72 per cent hemoglobin. The blood urea was 39 and blood sugar 152 mg. per 100 cc. Both the Wassermann and Kahn tests of the blood gave negative reactions.

Operation was advised and, because of the large size of the fistula, repair through a suprapubic cystotomy incision was deemed advisable.

Operation was carried out under spinal anesthesia with the patient in the Trendelenberg position. A midline suprapubic incision was

made along the old scar and carried down to the prevesical space. The bladder was identified and opened and, on retracting it, the fistula was exposed. It was found to lie immediately above the interureteric ridge and extend very close to the left ureteral orifice and across almost to the right ureter. Both ureters were catheterized to avoid injury, following which the mucosa of the bladder was carefully dissected away from the fistula, thus separating the vaginal mucous membrane from the mucous membrane of the bladder. The vaginal mucosa was brought together with a single row of interrupted sutures, following which the mucosa of the bladder was brought together with an interrupted layer of mattress sutures, causing the bladder mucosa to be inverted. The catheters were then removed from the ureters and the wound was closed, suturing the bladder snugly around a suprapubic mushroom catheter. The incision was then closed in layers as usual.

Immediately after operation, the patient was placed face down on a Bradford frame which was elevated about six inches above the bed, thus affording absolutely dependent drainage of urine from the bladder. The purpose of this was to prevent urine from bathing the operative area and by this means promote better healing of the wound. The patient remained in this position for five days, during which time absolutely no urine drained into the vagina. She was then removed from the Bradford frame and allowed to lie normally in bed. On the ninth postoperative day, the suprapubic tube was removed and an inlying urethral catheter was placed for continued drainage of the bladder. The suprapubic wound healed promptly and five days later the urethral catheter was removed. Normal voiding did not follow immediately and intermittent catheterization was required for two days; then urine was passed normally, quantities as large as 200 cc. being passed at a single voiding.

The convalescence was uneventful throughout and the patient was dismissed from the Hospital on the eighteenth postoperative day. At this time, she was able to void normally and there was no leakage of urine into the vagina. Recent word from the patient, three months after operation, informs us that she remains well, voids normally, and the capacity of the bladder has increased.

Comment

The suprapubic operation was elected because of the large size of the fistulous opening and the fact that the patient had had three operations previously. It has been our experience that the vaginal approach is more suitable in the cases where primary operation is carried out on small fistulae. It seemed to us that the dependent drainage afforded by the face-down position contributed a great deal to the success of the repair in this case. We claim no originality for this method of treatment

as it doubtlessly has been used many times by others, nor do we feel that it was necessarily indispensable to the cure which was obtained as the same favorable outcome might have occurred had it not been used. We had not previously employed it in any case of vesicovaginal fistula but, on theoretical grounds, it seems sound and we believe that we shall employ it more often in the future.

Incidence: The exact incidence of vesicovaginal fistula cannot be determined accurately but that it is not an uncommon lesion is indicated by the fact that 86 cases are found in the records of the Cleveland Clinic. Doctor Lower[1] reported 71 of these in 1935, since which time 15 cases have been added.

Etiology: The causative factors are shown in table 1, which shows that almost 50 per cent of all cases follow hysterectomy or other types of pelvic operations. Childbirth is another cause but improvements in obstetrical methods are decreasing the incidence of fistula due to this factor. A third common cause is malignancy, either of the cervix or the bladder, and in some cases the use of large doses of radium has contributed to the development of a fistula.

TABLE 1

Causative Factors in Vesicovaginal Fistula

Pelvic operations	42
Hysterectomy 36	
Other pelvic operations 6	
Childbirth	13
Resection of bladder (for carcinoma)	5
Carcinoma (untreated)	6
Radium	14
Not stated	6
Total	86

Diagnosis: The diagnosis ordinarily offers little difficulty, although occasionally the symptoms are erroneously interpreted as being due to urinary incontinence. In most instances, the fistulous opening can be demonstrated by careful speculum examination of the vagina, and the diagnosis may be finally established by injection of some dye, such as mercurochrome or indigocarmine, into the bladder and recovering the color on a vaginal pack. In most instances, cystoscopic examination should be carried out to determine the location of the fistulous opening in the bladder and also to rule out the possibility of a ureterovaginal fistula.

Treatment: The treatment is always surgical but no standardized operation is applicable. Many different technics have been described and advocated but the mutiplicity of methods serves only to emphasize the inadequacy of any one. The treatment must therefore be individualized and operation selected according to the lesion with which one has to deal. In the group of cases which we have seen, approximately 75 per cent have been repaired by the vaginal approach, whereas 25 per cent have been done through a suprapubic cystotomy. The decision as to which approach to select depends largely upon the size of the fistulous opening and its location. In general, the larger fistulae and those high up in an inaccessible portion of the vagina are best repaired by opening the bladder suprapubically. Successful repair of these fistulae is not a simple task and commonly operations are carried out repeatedly, one of our patients having had eleven operations before successful closure was achieved.

In a certain small group of cases, repeated attempts to repair these fistulae will fail and in certain others the fistulous opening is so large that repair is impossible. In such cases the ureters should be transplanted into the rectosigmoid, this having been necessary in nine patients in our series.

The high incidence of vesicovaginal fistula following hysterectomy and other pelvic operations emphasizes the importance of exerting great care to prevent the occurrence of this distressing complication. Although perhaps not absolutely preventable, its occurrence will be reduced if extreme care is taken in separating the bladder from the cervix when hysterectomies are performed and the avoidance of mass ligatures. The history of many of these cases indicates that the bladder is not actually opened at the time of the hysterectomy but the fistula developed later as the result of devitalization of tissue with subsequent sloughing. Thus, in most cases which follow hysterectomy, the history is that the leakage of urine into the vagina did not occur until a week or ten days following the operation.

Vesicovaginal fistula constitutes a most distressing lesion so that it is important to attempt to prevent its occurrence, but having occurred, it challenges the best efforts of the surgeon to secure its relief.

Reference

1. Lower, W. E.: Treatment of vesicovaginal and ureterovaginal fistula, Am. J. Surg., 28:234-241, (June) 1935.

DIFFERENTIAL DIAGNOSIS OF JAUNDICE

CHARLES L. HARTSOCK, M.D.

The yellow or greenish yellow staining of the blood plasma and body tissues, to which the clinical term jaundice has been applied, is due to an excessive amount of one of the normal constituents of the blood, viz., bilirubin.

To differentiate accurately the various causes of jaundice, one must understand something about the source, properties, and excretion of bilirubin.

Bilirubin is a product of the normal daily destruction of red blood cells which occurs at a surprisingly rapid rate, the estimated life of a red blood cell being from 4 to 30 days. As formed in the blood stream, bilirubin is strongly combined or attached to the blood proteins. To break up this combination with protein, the action of the liver cells or the presence of bile salts is required. When combined with protein, bilirubin cannot be excreted by the kidneys so that the liver normally acts as the only excretory organ of bilirubin to form the bile pigment of bile.

The liberation of the bilirubin from the protein is not completely understood but liberated bilirubin does not occur in the blood serum except in the presence of disease of the liver or bile ducts. The ease with which these two types of bilirubin can be distinguished by the so-called direct and indirect action of the qualitative van den Bergh reaction serves the very important purpose of immediately separating jaundice into two types:

(1) Hyperbilirubinemia due to increased production.

(2) Hyperbilirubinemia due to decreased excretion.

The first type must be due to some disease that increases the destruction of red blood cells. The second type must be due to some disease that affects the liver or bile ducts, thus interfering with the excretion of the normal production of bilirubin.

Jaundice or hyperbilirubinemia can be predicated in three ways. First is the actual measurement of the serum bilirubin. This is the most accurate but unfortunately not a simple laboratory test. The icterus index, a colorimetric method of studying the yellow pigment in the blood, is a much simpler and usually reliable method of quantitatively studying the amount of bilirubin in the blood serum. The only confusion arising from this test is the presence of extraneous pigments in the serum, such as carotene. The icterus index normally varies from 4 to 6 units. When examined in the best light and under the most favorable locations, the

eye, the third indicator of the presence of jaundice, picks up the yellow tinge when the icterus index reaches 12 to 15 units. Naturally, it is only when the mildest degrees of pigmentation are present that the more accurate method of determination of the serum bilirubin is necessary to differentiate the presence or absence of hyperbilirubinemia as the cause of the pigmentation.

The presence of jaundice determined, and the quantitative amount of the pigment estimated, the next procedure is to determine the cause. As mentioned previously, the simple van den Bergh qualitative test will easily differentiate between a jaundice of overproduction and jaundice of undersecretion. Only in the mild degrees of jaundice is this necessary as the severe degrees of icterus always are caused by disorder of the biliary tract.

If the jaundice is mild and the van den Bergh reaction is indirect, the jaundice must be due to increased destruction of the red blood cells. In such cases, the urine is acholic because combined bilirubin is not excreted by the kidneys. The urobilin content of the urine is usually increased because increased amounts of bile are reaching the intestine.

The problem becomes one of finding the cause of the increased hemolysis. The hemolytic blood dyscrasias, such as hemolytic jaundice, pernicious anemia, sickle cell anemia, paroxysmal hemoglobinuria, etc., must be differentiated. The hemolytic fevers, malaria, hemolytic septicemia, drugs such as phenylhydrazine, and transfusion reactions with hemolysis may cause mild degrees of jaundice. This type of jaundice is called hematogenous jaundice, is easily recognized as such, and the exact cause can usually be determined by appropriate studies.

The real problem in the differential diagnosis of jaundice is presented in those cases in which the hyperbilirubinemia is due to disease of the biliary system. In severe jaundice with icteric index values above 50, hematogenous jaundice need not be considered. The van den Bergh reaction will be direct, the urine will contain bile, and bile in the intestinal tract will be diminished or absent, resulting in low to absent urobilin in the urine. Such observations, however, are of little or no practical diagnostic value.

For practical therapeutic and prognostic purposes, there are three types of disease of the biliary tract that should be differentiated:

1. Cellular damage to the liver—
   Catarrhal jaundice or Weil's disease, acute yellow atrophy, toxic hepatitis due to drugs, etc.
2. Diffuse intrahepatic biliary obstruction.
   The cirrhoses, finely infiltrating malignancies, and other diffuse disease of the liver.

3. Extrahepatic obstruction of the large duct.
   Gall stones, pressure on the duct from tumors and scar tissue, etc.

The therapeutic indications and the prognosis vary so greatly in these three types of biliary jaundice that it is of the utmost practical value to be able to distinguish the type as early as possible.

To the first group in which the obstruction to the excretion of the bile is in the cells and finer biliary passages, the name hepatogenous jaundice is given. To the third group where the obstruction is in the large bile passages, the name obstructive jaundice is given. The second group is a combination of the first and third and might well be called the hepato-obstructive type.

In the hematogenous type, it was seen that laboratory procedure was the *sine qua non* of diagnosis.

In the biliary type, we must rely on much more inexact methods. The history of onset is most helpful. Fairly rapid onset of painless jaundice, preceded by a period of malaise, suggests hepatic damage.

Jaundice which appears rapidly following a painful abdominal episode suggests gall stones. The slow, insidious onset suggests the hepato-obstructive type or obstructive type due to slowly increasing pressure on the ducts.

A history of exposure to chemicals and drugs used as medicines is highly significant. Previous attacks of gall stone colic may be the deciding clue in the diagnosis.

It seems to me that not enough stress has been placed on the presence or absence of pruritis as a diagnostic aid. Acute hepatogenous jaundice in the early stages rarely causes pruritis. An exception to this is the hepatitis of cincophen poisoning where there is frequently an associated urticaria. Early pruritis is in favor of an obstructive jaundice while pruritis preceding the appearance of jaundice practically always means obstruction of the slowly progressive type.

Any marked change in the general health of the individual during the months preceding the onset of jaundice makes one suspicious of some underlying disease, such as cirrhosis or malignancy. If the patient is first seen after the jaundice has been present for some time, the variation in the degree of jaundice may be of some importance. Hepatogenous jaundice will usually be clearing from the second to the sixth week, but jaundice which progresses after the sixth week should be considered of obstructive origin.

It is rare, however, with the exception of the jaundice due to drugs and that following a typical gall stone attack, to learn anything from

the history that is helpful in answering the all-important question in early acute jaundice—to operate or not to operate.

The examination of the patient may furnish some additional information. Evidence of scratching only confirms what the patient was so anxious to tell you about the very annoying pruritis.

Palpation of the region of the liver may reveal changes in the size of the liver, whether smaller or larger than normal, the consistency if palpable, the presence of tumors in or near the liver, the presence of a palpable gallbladder. Ascites, collateral circulation, hemorrhoids, etc., must all be noted and evaluated in conjunction with other findings.

Evidence of malignancy elsewhere in the body, especially the stomach, rectum, and breast must be carefully searched for. The Wassermann reaction may be helpful. If a study of the blood shows macrocytosis, it would suggest that the liver was diffusely damaged.

The longer the duration of the jaundice, the easier it becomes by use of the above methods to make a diagnosis of the type of jaundice present.

Fortunately, in the case of early jaundice, we have a method that is of the utmost practical value in distinguishing between obstructive jaundice in which exploratory operation should be performed and hepatogenous jaundice in which exploration is not indicated. This is the galactose tolerance test. If a patient with jaundice is seen in the first two weeks, this test has a high degree of specificity but its value decreases rapidly if the jaundice has been present for a longer time and may even give just the opposite result from that which it should give. One of the functions of the liver is the storage and conversion of glycogen and glucose. Other carbohydrates, such as galactose, are converted into glucose before they are utilized or stored as glycogen. Galactose in the blood stream has no threshold value in the kidney and is completely eliminated in the urine. If, therefore, the glycogenic function of the liver is impaired to the extent that it will not convert galactose into glucose, there will be an excessive amount passing into the blood and then to the urine when galactose is given by mouth. Jaundice due to cellular damage would most likely interfere with this function, whereas an early jaundice due to obstruction could not damage the liver cells. As time goes on, however, the reverse is true. An increasing obstruction would gradually damage liver cells, whereas the damaged liver cells of an infectious or toxic jaundice would be gradually recovering their properties.

As usually given, this test consists of the administration of 40 grams of galactose by mouth and the quantitative estimation of the amount of reducing substance eliminated over a period of five hours. It is assumed that this reducing substance is galactose. If the quantity of galactose excreted is over 3 gm., it is assumed that the liver was unable to convert

the galactose into glucose and therefore the liver cells are damaged. If the liver cells are functioning properly, it is assumed the jaundice is of the obstructive type.

It can readily be seen how important it is to be able to differentiate between early catarrhal jaundice that should be treated expectantly and the early jaundice of obstruction that becomes an increasingly more dangerous surgical risk the longer the jaundice is present.

Unfortunately, this test is not helpful in distinguishing between the obstruction of the large ducts and the hepato-obstructive group.

I would also like to emphasize again the unreliability of this test after the second or third week of jaundice. Its results are so confusing at this time that it had better be omitted.

Roentgen examination is of little value in jaundice. Its value is limited to searching for malignancy, especially of the gastro-intestinal tract, and looking for the presence of opaque stones on a plain film of the gallbladder. Even their presence may be coincidental and not related to the real etiologic factor.

Other tests of liver function are of little or no value in the differential diagnosis of jaundice.

In the doubtful cases, to differentiate accurately between the obstructive type and the hepato-obstructive type and even at times the unusual hepatogenous type, it is necessary to explore the abdomen. There are many cases in which the exact etiology of the jaundice remains in doubt even after exploratory operation, so it is easy to realize the difficulty of making an exact differential diagnosis clinically.

Everything to gain and nothing to lose should be the idea with which these cases are approached from a surgical standpoint. Operations have repeatedly shown the fallacy of the clinical diagnosis of jaundice. The supposed carcinoma of the pancreas may be a chronic pancreatitis. The supposed cirrhosis may prove to be only an easily removed stone in the common duct with long-continued partial obstruction producing a secondary fibrosis of the liver. Other unsuspected but curable conditions may be found at exploration. I want to emphasize, however, that other methods of examination should be used to determine the diagnosis before surgery is attempted.

Summary

Hematogenous jaundice is easy to recognize and appropriate studies will, in most cases, reveal the underlying disease entities.

In the biliary group, a galactose tolerance test done early in the course

of jaundice should separate off the group due to damaged liver cells in which it is so important that no operation be performed.

Much better diagnostic methods are to be desired to distinguish between the pure, obstructive type that is so frequently amenable to surgery and the hepato-obstructive type in which surgery only shortens the patients' lives. At present, however, exploration must be utilized until better methods are discovered.

SOME CLINICAL CONSIDERATIONS OF BASAL METABOLISM

E. Perry McCullagh, M.D.

By metabolism, we mean the sum total of chemical change occurring in the organism. This includes not only processes of oxidation and reduction, but also synthesis and degradation of a large number of chemical compounds. Our total knowledge of the finer metabolic changes is meager and even the knowledge of the metabolism of hormones which have been known in relatively pure or crystalline forms for some time is not understood in any degree of completeness. Of the many measures of metabolism, the basal metabolic rate has become one of the most common and for that reason is of great practical significance. This consideration of the basal metabolic rate is for the main purpose of emphasizing the simple fact that it is a symptom and is of significance only in consideration of the total clinical picture. The metabolic rate is as much a symptom as the pulse rate or body temperature and not more specific.

Hyperthyroidism

The typical case of hyperthyroidism is always associated with hypermetabolism. In Grave's disease, remissions may occur, however, and at such times the basal metabolic rate may fall to normal. It is for this reason that one other factor is more important in the diagnosis of hyperthyroidism than an elevated basal metabolic rate, namely, a good history. In some of these cases, the presence of goiter, the facial expression so typical of the disease, some tachycardia, tremor or skin changes usually lead to the diagnosis. Iodine remissions may bring about the same changes. In some instances, it is necessary to observe the patient repeatedly. Cases of hyperthyroidism with the basal metabolic rate below the normal have been reported by Duncan Graham and Roger Morris[1]. Such patients have shown the usual improvement after thyroidectomy. Fortunately for us as clinicians, the opposite condition is more frequently true, however; i. e., in chronic low grade hyperthyroidism and in atypical hyperthyroidism, such as auricular fibrillation or cardiac failure of thyroid origin, the basal metabolic rate is usually high.

There are a few conditions which may closely simulate clinical hyperthyroidism and may be associated with elevated metabolic rates. The most outstanding of these is neurocirculatory asthenia. This condition occurs chiefly in young people and is not infrequently accompanied by a goiter. The basal metabolic rate is not consistently high, however, and although it frequently varies from plus 14 to plus 22 per cent, normal levels may be found subsequently. High readings in such cases

are probably not due to gross errors in technic but are to be related to the very unstable state of the sympathetic nervous system. The patient is frequently of the neurasthenic type although the condition is seen in otherwise strong, athletic individuals. The pulse is extremely variable, sinus arrhythmia is present, sighing is common, the hands are cold and moist, and a glove type of cyanosis, purple discoloration, or mottling may be seen. The pulse can frequently be slowed markedly by acute flexure of the trunk (Erben's phenomenon) or by pressure over the eyes or the carotid sinus. Flushing and blushing are common and excessive perspiration is present in the hands, feet, and axillae.

Hypermetabolism occurs in cases of cardiac decompensation but the condition in such instances is not usually basal because of dyspnea. There are, however, instances of arterial hypertension in which, as far as can be determined, basal conditions are obtained and yet the metabolic rate is high. These are usually cases of malignant hypertension with retinal edema or exudation about the vessels and perhaps retinal hemorrhage. Thyroidectomy in such cases may not lower the basal metabolic rate below normal. It is well to remember that a diastolic blood pressure of over 100 mm. of mercury is rare in hyperthyroidism.

Certain diseases of the blood, especially leukemia, may be associated with a high basal metabolic rate.

Hypothyroidism

If the thyroid gland is completely removed, the basal metabolic rate falls to minus 40 or minus 45 per cent and the clinical evidences of myxedema become apparent. Under other circumstances, however, the basal metabolic rate may fall to lower levels with none of the common clinical signs of thyroid failure.

The question as to how much the thyroid gland is implicated in the production of low basal metabolic rates without myxedema is not clearly settled. Certain facts appear to indicate that it may be little if at all involved. True myxedema can be controlled well with relatively small doses of thyroid, whereas patients with non-myxedematous hypometabolism may tolerate large doses with little change in the basal metabolic rate and relatively no change in symptoms. The blood cholesterol is usually not elevated in these cases as it is in myxedema. The clinical features differ also.

In true hypothyroidism arising from partial or complete destruction of the thyroid gland from disease, removal, or both, when the basal metabolic rate falls below minus 20, the characteristic nonpitting edema usually appears. In addition, there is a characteristic group of symptoms. Since there are many cases in which the basal metabolic rate is low in the absence of these symptoms and in order to decide whether or not

the case is one of hypothyroidism, it is necessary to be thoroughly acquainted with these symptoms and signs. The relative frequency with which they occur was judged from a study of 194 cases of hypothyroidism reviewed recently

The chief complaints were numerous and varied, as many as 25 symptoms being listed. The commoner ones, in order of their frequency, are:

Complaint	*Per cent*
Lack of endurance	93
Lack of energy	89
Tendency to nervousness	79
Drowsiness	78
Diminished memory	68
Numbness and tingling of the hands and feet	67
Stiffness of the joints	48

Constipation occurred in practically 50 per cent of the cases and, with this, abdominal pain may be a presenting symptom. Mild abnormalities of menstruation were common and were listed in 30 per cent of the women affected before the age of 40. Very minor changes which ordinarily would not be considered entirely abnormal were also listed. Diminution in sexual potency was not uncommon.

The signs which are so characteristic are not always very obvious. The patient's own observations frequently must be carefully considered and elicited by leading questions. Even in many of the mild cases, some edema is present. It was found in 67 per cent of our cases, occurring in the lower lids, the feet, and hands more frequently than elsewhere. Of the 194 patients, 48 per cent were underweight and 18 per cent overweight. The pulse rate was below 60 at rest in only 15 per cent of the cases. Red cell counts of below four million were present in 18 per cent. When anemia occurs, it is frequently accompanied by achlorhydria and this, together with the paresthesia of the extremities, may simulate pernicious anemia, especially since macrocytosis may occur. Achlorhydria was present in 22 per cent of the cases. The anemia of hypothyroidism responds better to iron plus thyroid therapy than to thyroid alone. The heart may be enlarged in all diameters as seen by roentgenograms. Electrocardiographic changes are common, the principal changes being flattening and inversion of the T-waves, occasionally prolongation of the PR interval, or QRS complexes. Mild albuminuria may occur and in outspoken myxedema the condition is often mistaken for nephritis.

In definite uncomplicated myxedema, the blood cholesterol is invariably elevated above 220 mg. per 100 cc. In such cases, thyroid medication gives almost complete relief of the symptoms.

In infants and children, the presence of hypothyroidism is not uncommon. Here the basal metabolic rate is not a very useful diagnostic measure and it is valuable to bear in mind that childhood hypothyroidism does not produce the clinical appearance of cretinism. In the milder cases, however, dentition may be retarded. In many instances, the mentality is affected but little and school work may be good. The growth rate tends to be diminished and a very useful sign is the slowness of the appearance of centers of ossification and delayed epiphyseal union. The blood cholesterol is usually high.

There is a clinical group of cases of subnormal mentality in children who come for examination in order that hypothyroidism may be excluded. Sometimes, there are distinct evidences of birth injury, but this may not be apparent. Large body size and obesity are common and, in children over ten years of age, low basal metabolic rates may be found. In these cases, if the bone age is normal, dentition good, and the blood cholesterol within normal range, thyroid medication is of little or of no value.

There is a much larger group of adults who have hypometabolism with little or no edema. Here, the cases range all the way from those patients with typical, mild symptoms and signs of hypothyroidism to individuals of the neurasthenic type who complain of little but fatigue. In many such cases, a definite diagnosis of hypothyroidism may remain questionable. In the majority of cases, improvement on thyroid therapy parallels in a general way the clinical evidence of hypothyroidism and not the level of the basal metabolic rate.

Exophthalmos, such as is seen in thyroid disease, is not infrequently associated with depressed basal metabolic rates. The fact that exophthalmos can appear or increase while the basal metabolic rate is rising and in the presence of hyperthyroidism, and the fact that it can appear or increase while the metabolic rate is normal or low indicates that the rate of metabolism in itself is not directly connected with the degree of exophthalmos. In patients with progressive exophthalmos, there is frequently a marked edema of the lids whether or not the basal metabolic rate is low. This may also affect the conjunctiva and there is congestion of the conjunctival vessels. In extreme cases, there may be ulceration of the cornea, extreme engorgement of the orbit, and enucleation may be necessary. It is remarkable that, in the presence of progressive exophthalmos postoperatively where the basal metabolic rate is minus 20 to minus 25 per cent, signs and symptoms of hypothyroidism may be entirely lacking. It is probably wise in such instances to give enough thyroid to maintain a relatively normal basal metabolic rate. Whether excess of thyrotropic hormone is intimately connected with the production of such exophthalmos is not known.

Pituitary abnormalities may cause marked changes in metabolism. In acromegaly, goiter is present in about 75 per cent of the cases and hyperthyroidism in some degree occurs in the active phase of the disease in the majority of these. Occasionally, very severe hyperthyroidism with basal metabolic rates increased to 100 or more may be seen. In the later stages of the disease, the metabolic rate falls below zero but the typical evidences of hypothyroidism do not occur. Thyroid medication is of limited value.

In the chromophobe adenomata of the pituitary, low basal metabolic rates are the rule. Frequently, they fall to minus 30 per cent, again without the typical evidences of hypothyroidism. The same may be true in craniopharyngiomas.

The symptom complex usually designated Fröhlich's syndrome is of frequent occurrence in boys and girls at about the age of puberty. In these cases, depressed basal metabolic rate is common. It is not infrequent to find rates ranging about minus 25 per cent. In the typical case, the child is obviously obese and the skin is of fine texture. The obesity is chiefly about the breasts, abdomen, and hips. The genitalia are retarded in development. Dentition is usually excellent and the bone age and blood cholesterol are normal. In the majority of such cases, the advent of puberty is followed by a return to normal conditions but this does not necessarily occur. Thyroid in small doses can be used to considerable advantage in conjunction with limitation of diet. The genitalia are frequently judged to be underdeveloped, due to the large accumulation of fat at the pubis, but simple reduction in weight is often all that is necessary to bring about what appears to be normal genital development. The diet itself does not need to be greatly restricted in most instances, and good results are consistent when the diet is reduced to one calculated to contain 20 per cent more than the basal caloric requirement for the ideal weight of the child. When the development of the genitalia tends to remain retarded, the persistent use of pregnancy prolan in doses of about 200 units three times a week will be followed by gratifying results in most instances if the treatment is continued for three or four months or more.

In pituitary cachexia, the basal metabolic rate falls to levels lower than those seen in myxedema. The patients have a characteristic pallor but the skin appears to be waxy and transparent. It may be slightly dry but no edema appears. There is a tendency to alopecia but it affects body hair much more than the hair of the scalp. Impotency in males and amenorrhea in females is an almost constant finding. Extreme emaciation usually leads to death but patients with severe cachexia following pituitary surgery may live for many years. Treatment of the condition is extremely difficult. Clinical results do not indicate that

suitable pituitary extracts are available in sufficient strengths. Until they are obtainable, normal nutrition is the chief therapeutic measure. Sporadic cases have been reported as cured following the use of antuitrin or antuitrin-S but the fact that improvement remained after treatment was stopped throws some doubt on the validity of the diagnosis.

Gonadal disease may have a bearing on the basal metabolic rate. In 11 male castrates, the average basal metabolic rate was minus 12 per cent. Gain in weight is consistent with the low metabolic rate. In eight female castrates, the average basal metabolic rate was minus 16 per cent. The low basal metabolism is not uncommon and signs of mild hypothyroidism are seen frequently at the female climacteric. When the metabolic rate is low and the symptoms are those of hypothyroidism, this can be treated as a separate entity entirely apart from whatever other endocrine disorders are present except for one fact, i. e., the sympathetic nervous system is excessively irritable and stimulated at this time and since thyroid produces further stimulation it must be used with considerable caution if the patient is to be kept comfortable. The use of ovarian hormone in the female or the continued use of large doses of testis hormone in the male will not raise the basal metabolic rate to a degree of clinical importance.

Thyroid deficiency, on the other hand, may be the cause of excessively low testicular function. We have seen cases of impotency in the male in relatively thin individuals who had basal metabolic rates of minus 25 or minus 30 per cent and showed unusually low readings for assays for testis hormone in the urine. In one individual, a physician of 45 years, the amount of testis hormone in the urine was between zero and five international units per day, whereas the normal range usually lies well above 20. His basal metabolic rate was minus 27 per cent and there were some symptoms of hypothyroidism. Injection of testosterone sufficient to bring the testis hormone content of the urine to within normal ranges caused disappearance of impotence, and sexual vigor improved to about 75 per cent of normal. The basal metabolic rate, however, did not rise. Subsequently, when this treatment was stopped and symptoms were still present, it was found that a greater amount of symptomatic improvement could be obtained by the use of thyroid alone. In addition, after thyroid had been used for a month, the amount of testis hormone in the urine was within normal range, reaching 44 units in a 24 hour specimen of urine. This, of course, could not be ascribed to the effect of the testis hormone previously injected. When sterility is associated with hypometabolism, a cure may follow the use of thyroid.

When disorders of menstruation accompany distinct clinical evidences of hypothyroidism and a low basal metabolic rate, clinical improvement, in the majority of cases, follows the administration of thyroid

without other treatment. It is more remarkable that, in many women with menstrual disorders in the absence of other signs of hypothyroidism, the administration of thyroid alone may be followed by clinical improvement.

In Addison's disease, the low basal metabolic rate can probably not be explained on a satisfactory thyroid basis and may be related directly to nutrition. It is possible that a lack of adrenal cortical hormone may play a rôle but there is no definite evidence to indicate that such is the case.

Low basal metabolic rates are common in cases of atrophic arthritis. It is interesting, however, that on taking an unselected group of 31 cases of atrophic arthritis in which determinations of the basal metabolic rate had been made, the average rate in the whole group was only minus five per cent. Although such arthritis can in no way be ascribed to thyroid failure, small doses of thyroid may be a useful adjunct in the treatment when the metabolism is low.

In true lipoid nephrosis, the basal metabolic rate is usually distinctly depressed, rates of minus 25 to minus 35 per cent being common. The mechanism of this depression is not known. It has been suggested that large amounts of thyroid hormone may be lost with the proteins in the urine. In such cases, the basal metabolic rate may be excessively difficult to raise by the use of thyroid and questionable clinical improvement results. In some cases, diuresis increases following thyroid administration.

Hypersecretory rhinitis will sometimes improve remarkably following thyroid administration.

Nutrition has a very marked influence on the basal metabolic rate. In extreme obesity, however, it is very unusual to find excessively low basal metabolic rates. Von Grafe believed in the Theory of "Luxus Konsumption," that is, that the metabolic rate could be increased in proportion to the amount of food taken and that in a normal individual this explained the fact that obesity did not occur while following a diet which was not carefully controlled. He recognized, however, that if this theory were accepted, such a control of metabolism must at times break down because otherwise there would be no cases of obesity. It appears to have been definitely proved that, when nutrition is normal, the basal metabolic rate tends to remain normal but if the food intake is high, the basal metabolic rate is not stimulated beyond normal range, the excess of food being stored. In undernutrition, however, the basal metabolic rate falls and we, as clinicians, frequently unwittingly change it by diets or do not meet a given basal metabolic rate with sufficient nutrition.

In cases of fever, the patient may be kept on a low or average intake while the basal metabolic rate may be remarkably increased because

of the fever. On the other hand, considerable depression of the basal metabolic rate may be produced by causing undernutrition due to such diets as are frequently prescribed in hypertension or obesity.

It is important to remember that simple fasting alone may lower the basal metabolic rate to minus 30 per cent or below. Benedict's[2] famous experiments in fasting showed that his patient, Levanzin, had a basal metabolic rate of minus 31 per cent at the end of three weeks' fast. Benedict has also shown that groups of students who are maintaining stationary weights at a caloric intake of about 3000 calories per day could also maintain stationary weights on an intake of 1900 calories per day. Such a weight balance was made possible because the basal metabolic rate fell following the use of lower caloric intakes for a period. Clinically, such a mechanism explains the fact that certain individuals lose weight rapidly when a limited caloric intake is begun but stop losing weight after a few weeks even though the same diet is maintained, the metabolic rate having fallen meanwhile to a point which balances the low intake. In such cases as this, it is frequently imperative to maintain a normal basal metabolic rate by the use of thyroid if it is desirable to continue the reduction in weight at the original rate and by means of the same diet. Where reduction of very large amounts of weight is required, it is also necessary to bear in mind that the basal caloric requirement for a very stout individual is much more than that for the same individual after the weight has been reduced, due to change in total bulk of the individual and granting that the metabolic rate is still normal.

Anorexia nervosa is a term applied to a group of symptoms resulting from psychic disturbances and leading to starvation. The clinical characteristics are sufficiently constant to warrant its acceptance as a disease entity. In such individuals, the psychic disturbance is followed by an extreme loss of appetite, marked decrease in food intake, inanition, and basal metabolic rates frequently as low as minus 40 per cent. A basal metabolic rate of minus 76 per cent was found by Wittkower[3] in such a case. The clinical features of hypothyroidism are not present, although the individuals may be intolerant to cold. The condition usually occurs in women between the ages of 18 and 35 years. Amenorrhea is present in almost all cases. Symptoms of functional disturbance of the gastro-intestinal tract are very common. Secondary anemia of consequence is usually not present although it may be overshadowed by hemoconcentration. These cases are frequently mistaken for Simmonds' disease which, it appears to me, has become an unduly popular diagnosis in the past few years. Since the differentiation between anorexia nervosa and true Simmonds' disease is very difficult, it may easily be that some of the cases reported as Simmonds' disease are really primary psychic disorders.

In anorexia nervosa, spontaneous improvement and recovery may occur and the menses return. I have recently observed a case in which a girl of 18 complained of extreme loss of appetite, amenorrhea, and loss in weight. The only distinctly physical abnormalities, apart from her weight, were indicated by the glucose tolerance test which showed potential diabetes mellitus, and the basal metabolic rates were minus 42 and minus 40 per cent. Her height was sixty-four and one-half inches and her weight varied at about 90 to 95 pounds. Between 1932 and 1934, various forms of treatment were tried, including attempts to have her use a high caloric diet, insulin, large amounts of salt and water, antuitrin, antuitrin-S, prephysin, pituitrin, enforced rest, large doses of vitamins, and a thorough trial on adrenal cortical extract (eschatin). When the treatment was finally stopped in February, 1935, her weight was 95 pounds and she felt no better. When she was seen in May, 1937, at the age of 21 years, her weight was 159 pounds and she appeared energetic and in excellent health. The breasts had developed normally; the nipples, however, were quite small, and the hips were unduly large. The uterus was somewhat underdeveloped and there was still amenorrhea.

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HYPERTHYROIDISM IN THE EXTREMES OF LIFE

GEORGE CRILE, JR., M.D.

Hyperthyroidism is rarely encountered in patients in the extremes of life. In a series of 13,200 consecutive cases of hyperthyroidism seen at the Cleveland Clinic since 1925, there have been only 42 cases in children under 14 years of age and only 45 cases in patients beyond the age of 70. The youngest child undergoing thyroidectomy for hyperthyroidism was a boy of 2½ years and the oldest patient was a man 81 years of age. (Figs. 1 and 2.)

FIGURE 1: This boy, two and one-half years of age, had diffuse goiter with severe hyperthyroidism. Subtotal thyroidectomy was performed and he was well two years after operation.
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The reaction of the feeble and elderly patient to hyperthyroidism and to thyroidectomy is quite different from that of the child or the young adult. A comprehension of these differences is of value not only in the treatment of the rare cases of hyperthyroidism occurring in children and in old age, but also in the management of the numerous cases of hyperthyroidism in patients in the fifth and sixth decades of life.

FIGURE 2: Photograph of man, 83 years of age, who had nodular goiter with hyperthyroidism. Thyroidectomy was performed and he is well two years after operation.

In this series, hyperthyroidism in children was always associated with a diffuse enlargement of the thyroid whereas adenomatous glands were present in 96 per cent of the patients over 70 years of age. In the aged, the clinical picture of hyperthyroidism is distorted by the myocardial, vascular, and cerebral changes of senility. Striking differences in the clinical expression of hyperthyroidism in children and in the aged are therefore found.

Exophthalmos occurred in 76 per cent of the children in this series, and in 14 per cent of the cases it appeared so early and was so marked that it was considered the leading symptom. In the aged, however, exophthalmos was rarely seen and was never severe.

In the aged, the predominating symptoms were nervousness, weakness, exhaustion, and loss of weight. In 20 per cent of these patients, the leading symptoms were attributable to cardiac decompensation and in 40 per cent either auricular fibrillation or cardiac decompensation was present. In the children, no instance of cardiac decompensation occurred and auricular fibrillation was not observed.

Hyperthyroidism in the aged expresses itself as exhaustion. The myocardial reserve, the nutrition of the body, and the energy of the

organism are depleted by the constant demands of hypermetabolism. It is in children and in young adults that the full-blown stimulation of exophthalmic goiter in its typical form is seen.

As a rule, children with hyperthyroidism do not lose much weight and remain fairly well nourished. Nervousness, ceaseless activity, emotional disturbances, tachycardia, and exophthalmos are the predominating symptoms. The nervousness and hyperactivity may even be so marked as to result in choreiform twitchings. In two cases in this series, chorea was suspected when the child was first seen. If it is remembered that hyperthyroidism in children is almost never "masked" and that it rapidly assumes the clear-cut state of stimulation characteristic of exophthalmic goiter, needless operations on simple adolescent goiters will be avoided.

It is chiefly in the aged that hyperthyroidism, masquerading as organic heart disease, is unsuspected until examination of the thyroid reveals the presence of an adenoma. Characteristic, then, of hyperthyroidism in the aged is the nodular goiter with nervousness, cardiac symptoms, or weakness as the chief complaint.

Although the presence of complications often obscures the diagnosis, the basal metabolic rate is reliable in the aged, and except in the presence of cardiac decompensation a consistent elevation of the metabolic rate is strong evidence for the diagnosis of hyperthyroidism. The basal metabolic rate which was determined in 27 of the cases varied from plus 9 to plus 70 per cent and averaged plus 27 per cent. In only two instances was it above plus 45 per cent.

Many of these patients had had large amounts of iodine for long periods of time and this treatment had produced hard nodular glands that were of a consistency suggestive of malignancy. In the presence of hyperthyroidism, however, malignant tumors of the thyroid are extremely rare, less than 0.5 per cent in our experience,[1] and hence it is well to consider any goiter associated with hyperthyroidism as benign unless unmistakable signs of malignancy are present.

The basal metabolic rate is of less diagnostic value in children than in adults. The standards are not so accurately determined and wide variations occur as a result of failure of the child to cooperate. The highest basal metabolic rate in this series was plus 87 per cent, the average being plus 36 per cent. In the 20 cases in which the basal metabolic rate was determined, the reading was below plus 5 per cent in only one instance, and this patient had been treated with iodine before the test was made.

Although clinical findings are of much more value than laboratory tests in establishing the diagnosis of hyperthyroidism in children, the determination of the level of the blood cholesterol is of definite value. The cholesterol in this series varied from 110 to 160 mg. per 100 cc.

of blood and was low in every case in which its value was determined. Roentgen examination of the epiphyses will often show development in advance of that normal for the bone age. Determinations of the level of the blood iodine have been disappointingly variable.

The treatment of hyperthyroidism in children is the same as that in the adult, subtotal thyroidectomy. Prolonged attempts at conservative management are undesirable because of the danger of the development of permanent exophthalmos. In one case in this series, a child of four was first seen because of nervousness. A diagnosis of chorea, with a question of hyperthyroidism, was made and small doses of iodine were given. Marked exophthalmos developed within a period of two months and, although thyroidectomy was performed, the child, now seven, has a residual exophthalmos sufficiently marked to require a tarsoplasty.

The remission of hyperthyroidism in children in response to bed rest and iodine is usually satisfactory and the operation is therefore safe. There were no deaths among the 37 patients on whom operation was performed. Before the use of iodine, thyroidectomy in children was considered to entail considerable risk and a large proportion of the patients were subjected to stage operations. In the last 20 cases, however, we have divided the operation in only two instances and we now believe that a child with hyperthyroidism is an excellent surgical risk.

Following thyroidectomy, the reactions of the pulse and temperature in children are often severe. In seven instances, the pulse rose above 170 and the average temperature reaction was more severe than in an adult. Although the patients often looked quite sick on the first day after operation, the reaction always subsided quickly and in no instance was the patient's condition considered critical. Convalescence was rapid and smooth with the exception of two instances in which a transient tetany developed.

The end results of thyroidectomy for hyperthyroidism in children have been excellent. Thirty-two of the 36 traced patients have remained free of symptoms and have developed normally. In one case, a psychosis resembling an early schizophrenia appeared about four years after operation, and in one patient a troublesome neurocirculatory asthenia developed. Hyperthyroidism recurred in two instances, both patients being young children whose hyperthyroidism was severe. We formerly believed that a little more gland should be left in children than in adults in order to guard against the development of hypothyroidism during the years of the child's development. This complication has not occurred, and I now believe that the operation should be as complete in a child as in an adult with an exophthalmic goiter. A second operation has effected a permanent cure in both the cases in which there was a recurrence. The formation of keloids in the thyroidectomy scar of children

is a common occurrence and can best be controlled by irradiation with grenz ray soon after operation.

In children, our experience with conservative therapy has been unsatisfactory. Only three patients in the entire series improved enough on medical management to avoid operation. It is unwise from either a physical or psychological viewpoint for a child to lead a guarded life of chronic invalidism during the developmental years. The risk of operation is slight and the end results are excellent.

In the aged, however, it is my belief that cases should be selected carefully before surgery is recommended. In 20 of the 45 patients over 70 years of age, operation was considered inadvisable. Operation was performed on 24 patients with five postoperative deaths, a mortality rate of 21 per cent. In addition, one patient on whom merely a ligation was performed became delirious and died at home a few weeks after operation without ever having fully regained his reason.

Roentgen therapy is not of much benefit in the control of hyperthyroidism associated with a nodular goiter, but it was attempted with indifferent results in five cases. Satisfactory remissions were obtained with iodine alone in several instances, but many of the patients remained chronic invalids or soon expired. In justice to the conservative form of management, it must be remembered that the majority of the patients not subjected to operation were hopeless risks in which good results could not be expected from any form of therapy.

The operation was performed in stages in 58 per cent of the cases and in one-fourth of the cases ligations were done. In spite of this conservatism, the postoperative reactions were alarming. Approximately one-half the patients became delirious after operation and many were critically ill. Pneumonia was the cause of death in three instances while cardiac failure accounted for one death and "metabolic exhaustion" for the fifth (Figs. 3A and 3B). By "metabolic exhaustion" is meant the unclassifiable "fading away" which is occasionally seen following thyroidectomy in feeble and in elderly patients. Without any particular elevation of the temperature and often without alarming elevation of the pulse rate, the patient will become confused, enter a state of muttering delirium, and will succumb without any obvious cause of death either clinically or on postmortem examination.

Pulmonary complications, often intervening in the course of the reaction described above, are the greatest threat to the aged patient. Beyond the age of 60, pneumonia is the most common cause of death following thyroidectomy for hyperthyroidism. Starting with apathy or mental confusion, the aged patient will become progressively weaker. Pulmonary congestion may occur as a result of a failing myocardium.

A B

FIGURE 3A: A woman, 62 years of age, had severe hyperthyroidism of long duration. She had lost 62 pounds in weight, was emaciated, and extremely weak. Photograph shows the appearance of exhaustion. It is in this type of case that a postoperative reaction characterized by "metabolic exhaustion" is seen. FIGURE 3B: Same patient shown in Figure 3A. Alive and well four years after thyroidectomy.

Mucus from tracheal irritation accumulates and the delirious patient will be too weak or too uncooperative to attempt to cough it up. Oftentimes, by withdrawing all sedation and by giving caffeine, the patient can be aroused. The foot of the bed is then elevated on high shock blocks to an angle of nearly 30 degrees. The patient is placed on his side or on his abdomen and is urged to cough. With this form of postural drainage, large amounts of mucus can often be discharged, thus producing dramatic relief of cyanosis and dyspnea.

Far more important than the management of these complications is their prevention. In poor risk patients, the development of any complication will probably result in a fatality. The complications which are so difficult to treat are relatively easy to avoid.

Any patient who is over 60 years of age and has hyperthyroidism must be considered a relatively poor risk. The mortality rate in this group is more than four times as high as in patients under 60. Elderly patients should, therefore, be given the full benefit of bed rest and iodine until the pulse rate has fallen as low as it will fall and the patient is gaining weight. The diet is important and should be high in carbohydrate in order to insure an adequate supply of glycogen to the liver. We have found that the bromsulphalein test of liver function shows dye retention in a high percentage of the older patients with hyperthyroidism and we believe this weakness can best be corrected by the administration of a high calorie, high carbohydrate diet.

In children and in strong, young adults, it is neither necessary nor desirable to perform thyroidectomy under local anesthesia. In these cases, a basal anesthesia of 70 mg. of avertin per kilogram of body weight is of great value and results in analgesia without undue depression. Children and patients with extremely high basal metabolic rates are more tolerant of depressant drugs and the dosage must be increased in these cases in order to obtain the desired analgesic effect.

In the aged, depression, whether induced by inhalation anesthesia or by basal anesthetic agents, must be avoided. Any depression of respiration, of the cough reflex, or of the internal metabolism of the body may lower the vital reserve below the threshold of resistance to a terminal pneumonia. The operation must be performed under local anesthesia with a minimum of gas oxygen analgesia. In children and strong, young adults, even in the presence of severe hyperthyroidism, divided operations should rarely, if ever, be necessary. With modern methods of preparation for operation and with good postoperative care, severe thyroid crises are rare. Strong, young patients tolerate even severe reactions with relative safety. But when weakness and emaciation are associated with longstanding severe hyperthyroidism in an elderly patient, the risk is great, and the operation should be divided. Ligations are reserved for only the most desperate risks, but hemithyroidectomy should be performed in many cases. The opponents of divided operations have stated that this technic merely exposes the patient to the risk of two operations instead of one. When performed under local anesthesia, however, the risk of the second stage is negligible. Although there have been 49 deaths following the first stage of divided operations, we have never lost a patient following the second stage when he has been sent home to recuperate between stages. I am convinced that many patients who barely survived the first stage would not be alive today if a subtotal thyroidectomy instead of a lobectomy had been performed.

I have seen only one case of recurrent hyperthyroidism in a patient over 65 years of age at the time of the first operation. Since recurrent hyperthyroidism is rare in elderly patients, it is not necessary to remove as much of the gland as in younger patients. A fringe of gland protecting the trachea is additional insurance not only against injury to the recurrent laryngeal nerves, but also against tracheal irritation, the formation of mucus postoperatively, and the development of pulmonary complications.

Immediately following the operation, a blood transfusion should be given to all bad risk patients. It has been clearly demonstrated that the ice-cooled oxygen tent, by increasing the oxygen-carrying power of the blood and by refrigerating the inspired air, minimizes the postoperative reactions of the pulse and temperature. The hyperthermia of a

thyroid reaction will nearly always fall one or two degrees in response to this form of therapy. All aged patients are placed in an oxygen tent immediately after operation and remain there until the height of the reaction is passed.

A 5 or 10 per cent solution of glucose given in the anterior malleolar vein by the continuous drip method has been of the greatest value in combatting the postoperative thyroid reaction. On the first and second day after operation, at the time when the patient's metabolism and caloric requirement is the highest, his ability to take nourishment is at its lowest ebb. Glucose given intravenously by the drip method is easily, continuously, and rapidly oxidized, prevents acidosis, insures adequate renal function, protects the liver, and minimizes the postoperative febrile reaction.

The administration of barbiturates to elderly patients with hyperthyroidism may precipitate a psychosis or even a state of maniacal delirium. Morphia and codeine are the most valuable drugs at our disposal in the postoperative treatment of patients with hyperthyroidism. In children and young adults, morphia should be given in doses sufficient to obtain complete relaxation and analgesia. In the aged, however, undue depression may result if the usual doses are given and we have found that confusion, delirium, and depression are minimized if the dosage of morphia is limited to ⅛ of a grain or if only codeine is given. As Dr. Crile Sr. has stated,"Old age is its own analgesia."

In the child or young adult with severe hyperthyroidism, we must do everything in our power to combat the hyperthyroidism and depress the stimulation and the emotional drive of the thyroid crisis. A basal anesthesia of avertin and postoperative sedation with large doses of morphia are our allies in this campaign. In the aged, however, we must direct our therapy toward maintaining and building up the dwindling vital reserves of the patient. Excessive sedation combats this end and should be avoided.

HYPERTHYROIDISM IN THE EXTREMES OF LIFE

Summary

The following table summarizes, in contrast, the manifestations of hyperthyroidism in the extremes of life.

Children under 14	*Patients over 70*
Hyperthyroidism expresses itself as stimulation	Hyperthyroidism expresses itself as exhaustion
Exophthalmos is the rule	Exophthalmos is rare
Goiter is diffuse	Goiter is adenomatous
Cardiac complications absent	40 per cent of patients have auricular fibrillation or cardiac decompensation
Diagnosis usually clear	Complications may obscure diagnosis
Basal metabolic rate unreliable	Basal metabolic rate reliable
Reaction of pulse and temperature to operation tends to be severe but patients do well	Reaction to operation tends to be mild but complications are common
No deaths following 37 operations	Mortality rate 21 per cent
Treatment of choice— Subtotal thyroidectomy, one stage	Treatment of choice— (1) Conservative management in 50 per cent of cases (2) Thyroidectomy in stages in selected cases
Basal anesthesia with avertin	Local anesthesia
Keep patient relaxed and analgesic with sedation	Avoid excessive sedation and attempt to build up resistence of patient
Postoperative complications very rare	Delirium occurs in 50 per cent of cases and pulmonary complications are common

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TEN YEAR CURES OF MALIGNANT DISEASE BY ROENTGEN THERAPY

Report of Three Cases

U. V. PORTMANN, M.D.

For less than forty years, roentgen therapy has been employed for the treatment of malignant diseases. The methods of administering the treatment have changed rapidly as knowledge of the biological and physical aspects of radiation has increased and mechanical improvements have been made. Frequently, it is difficult to evaluate the benefits of roentgen therapy because the patients to whom it is administered often have extensive disease and are hopelessly ill from the standpoint of curability. The treatment is given for the palliation of pain or to extend the economic usefulness of the patients, especially after other therapeutic procedures have failed or were contraindicated. Actual cures of malignant diseases by roentgen therapy in the past have not been common; however, they have been reported more and more frequently during the past few years.

The following cases serve to illustrate what has been accomplished by the use of the methods employed more than ten years ago.

Case 1: A man, 40 years of age, was seen in June, 1923, complaining of gastric disturbances. A mass was palpable in the epigastrium, and this caused a deformity by pressure upon the stomach as shown by roentgen examination.

A clinical diagnosis of extragastric tumor was made and laparotomy was performed by Dr. William E. Lower. A very large, soft, purplish, extremely vascular, retroperitoneal tumor was found to occupy the epigastric portion of the peritoneal cavity. The growth extended laterally downward to the level of the third lumbar vertebra and was in contact with the right kidney but did not involve it. The stomach and hepatic colon were adherent but did not seem to be invaded. It was impossible to remove this mass which was considered to be a highly malignant neoplasm, probably a retroperitoneal sarcoma.

Biopsy was performed and, on microscopic examination, the specimen was called a round-cell sarcoma. The pathologist in reviewing this tissue recently has called it alveolar carcinoma.

Within a period of five days, after the operation and during convalescence, roentgen therapy was administered. This was during July, 1923. The factors employed were 200 Kv. filter of 0.75 mm. copper plus aluminum, at 50 cm. distance. Although dosage was not measured in roentgens at that time, it is estimated that the area in which the epigastric tumor was located received approximately 1000 roentgens through the anterior and posterior fields.

The patient remained well and had no complaints but the epigastric tumor was still palpable four months after treatment. A second course of roentgen therapy similar to the first was given and, following this, the tumor was no longer palpable.

Six months later, although the patient was well in other respects, he complained of pain in the lumbar region. Roentgen examinations of the spine and chest showed no evidence of metastases but some pressure deformity in the

stomach still existed at the level of the first and second lumbar vertebrae. A third course of roentgen therapy was administered at this time. During the period of treatment which lasted ten months, the total roentgen dosage to the tumor area was approximately 3000 roentgens.

Three months after the third course of treatment, no deformity in the stomach was demonstrable by roentgen examination, nor has there been any since that time. The patient has been well, as far as evidence of malignancy is concerned, for almost fifteen years and no doubt roentgen therapy cured the retroperitoneal alveolar carcinoma.

Case 2: A man, 67 years of age, was seen in March, 1923, complaining of goiter. He said that he had had an enlargement of the neck since boyhood but that it had not changed in character until about ten years previously. Since that time, there had been a gradual increase in the size of the goiter and during the preceding year it had grown much more rapidly. He had a sensation of pressure in his throat, was nervous and disturbed by palpitation, and had lost about 30 pounds in weight. The thyroid gland was very hard and contained several irregular, hard tumors, ranging in size from that of a nut to an orange. The right side was especially involved so that the trachea was pushed to the left. The tumor had apparently invaded the surrounding muscles and in the supraclavicular areas there were palpable nodes, all of which were firmly fixed. There was no interference with the vocal cords.

Roentgen examinations of the chest and skeletal system showed no evidence of metastases. Dr. George Crile removed the major portion of the right and median lobes together with a part of the left lobe of the thyroid in order to free the tracheal obstruction to some extent. Microscopical examination of the removed tissue was made by Dr. Allen Graham who named it malignant adenoma.

Immediately after convalescence, roentgen therapy was administered. This was in April, 1923. The factors used were 200 Kv. filter of 0.5 mm. copper plus aluminum, at 50 cm. distance. The dosage is estimated at approximately 800 roentgens on the skin to each side of the neck and the mediastinum.

Three months after the treatment the patient was feeling much better and, although the mass on the left side of the neck had been reduced in size, that on the right side seemed to be increasing and a new tumor had appeared just above the clavicle. Roentgen therapy was again administered, and was repeated one year later because, although the tumors were very much smaller, they were extremely hard and fixed, and were thought to be potentially malignant.

During the ensuing years, the tumor masses in the neck remained stony hard but quiescent. The patient was entirely free from symptoms referable to the thyroid malignancy. As he grew older a chronic myocarditis with coronary sclerosis developed and he died of this condition in September, 1933, at the age of 77 years.

This patient lived for more than ten years and no doubt was cured by roentgen therapy of an advanced, inoperable, malignant adenoma of the thyroid.

Case 3: The patient, a woman 26 years of age, was seen in March, 1924, complaining of a shifting pain in the lower part of the abdomen and in the suprapubic region. Examination revealed a large mass in the pelvis. This was thought to be a pedunculated fibroid of the uterus although menstruation was normal. At laparotomy, which Dr. George Crile performed, a large, cellular tumor of the left ovary was found. The mass occupied the cul-de-sac and this was removed.

On microscopic examination, the tissue proved to be a medullary carcinoma of the ovary.

Consideration was given to the advisability of using roentgen therapy but this was thought to be unwise because it was possible that all the malignant tissue had been removed and, in that event, it would be undesirable to bring about menstrual disturbances in a woman less than 30 years of age.

The patient remained well for almost two years and then she returned, complaining of severe pain in the bladder area, pressure on the rectum which caused constipation, and the loss of considerable weight. Menstruation had been normal. Examination at that time revealed a very large mass in the pelvis. It encroached upon the rectum, bladder, and uterus, and apparently invaded these organs. The tumor was sufficiently large that it could be palpated through the abdominal wall. A diagnosis of recurrent carcinoma of the ovary was made and Dr. William E. Lower performed a laparotomy because of the obstruction of the rectum. At operation, the uterus was found to be very large, hard, and smooth. It was removed in order to obtain a satisfactory exposure of the area about the rectum which was found to be surrounded and invaded by a neoplastic growth so extensive that colostomy was necessary.

On microscopic examination, the uterus proved to be leiomyomatous and, of course, the rectal obstruction was caused by extensive recurrence of the ovarian carcinoma.

Roentgen therapy to the pelvis was given during convalescence for a period of ten days during September, 1926. The factors employed were 200 Kv. filter of 0.75 mm. copper plus aluminum, at 50 cm. distance. Although the dosage was not measured, it can be estimated that the pelvic cavity received approximately 1000 roentgens through one sacral and three abdominal fields. A similar course was given about two months later.

The patient continued to improve, presenting no evidence of recurrence of the malignant disease and, except for menopausal disturbances, caused by the treatment, remained well during the next year. At that time she began to object to her colostomy and, therefore, this was closed since she had no gastrointestinal disturbances and there was no evidence of rectal obstruction. At this operation there was no evidence of the neoplastic disease.

The patient has remained well for more than ten years and no doubt roentgen therapy cured an extensive postoperative recurrence of medullary carcinoma of the ovary.

THERAPEUTIC TYPHOID SHOCK

JOHN TUCKER, M. D.

Nonspecific typhoid shock provides a safe and important method for the production of artificial fever. We have had no unfavorable results and no deaths following its use in several hundred patients. Furthermore, we have found that the fever and chills caused by the intravenous administration of typhoid vaccine have produced satisfactory improvement in properly selected cases. The glands and other cellular tissues of the body participate actively in the febrile reaction which may serve not only to place the pathogenic bacteria in an environment that is unfavorable to viability and reproduction, but the reactions of the cells may serve to enhance the formation of antibodies as well. Some authorities doubt that this twofold reaction can be produced by passive fever induced in the heat cabinet. Likewise, many syphilographers declare that, in the treatment of general paresis, the end results are better after a course of chills induced by malaria than after treatment in the heat cabinet even though, in the latter instance, the temperature may be maintained at 105° to 106.5° F. for as long as six to eight hours. We recognize, too, that in a disease such as erythema nodosum the lesions may disappear with great rapidity when milk protein is given intramuscularly. In this instance, no fever, no chills, and no noticeable general reaction or discomfort occur. This nonspecific effect of protein appears to be active in the reaction to typhoid shock.

There are certain objections to heat therapy produced by use of a cabinet, especially because it is apt to be both expensive and exhausting. While there are many conditions in which this treatment is of great value and should be employed, there are many diseases that will respond to typhoid shock. In such instances, the expense is not great and the procedure is simple. Each method is designed to accomplish certain things. For instance, it is known that the thermal death point of the gonococcus is in the neighborhood of 106.7° F. for two hours in vitro. In patients of robust constitution, it would be inadvisable to treat infections caused by this organism by any other method, but in debilitated subjects, typhoid vaccine can often be employed with considerable benefit.

Knowledge concerning the effects of hyperthermia as a therapeutic procedure is still in a formative stage. Many diseases have been cured or greatly helped by keeping the body at a high temperature for many hours. In our experience, the best results of treatment in the cabinet have been in the gonorrheal diseases. However, this method is used in many other conditions where ordinary therapeutic methods have failed. In a specific case, after a careful clinical and laboratory examination has been completed, a conference is held with the head of the

Physiotherapy Division. We recognize that the artificial fever produced by hyperthermia causes copious sweating with the loss of body fluids and chlorides. This dehydration and demineralization is compensated for, to a considerable extent, by copious draughts of liquids and by the administration of sodium chloride. At all times during the treatment, the patient is under careful medical supervision. Even so, many patients who might improve with artificial fever are not physically able to undergo this ordeal and many of the patients who receive therapeutic typhoid shock in our hospital are from this debilitated group.

The physiologic changes that occur in the body during fever are not well understood. It does appear, however, that many functions of the body are modified for a time, at least, by an elevation of temperature to fever levels. The body metabolism rises about 7 per cent with each degree of increase in temperature, the pulse rate increases, and the pulse pressure enlarges due to a rise in systolic and fall in diastolic pressures. Studies of the capillaries reveal an increased minute volume of blood flow through the peripheral channels. With stimulation of circulatory and glandular processes within the body, there undoubtedly is better mobilization of the mechanisms of tissue defense and better removal of toxic waste substances. At the onset of the chill, the number of leukocytes in the peripheral circulation diminishes. In a very short time, there is a definite rise in the number of polymorphonuclear cells and eosinophils, associated with some decrease in the lymphocytes. The effect of fever on the pathogenic bacteria is probably bacteriostatic. If the temperature is high enough, there may be a decrease in the multiplication and likewise death of many organisms.

Changes in the chemistry of the blood during hyperthermia are not very striking. Among the variations are an increase in the blood uric acid and total nonprotein nitrogen. There is a slight fall of the carbon dioxide and, if sweating is profuse, the blood chlorides may diminish somewhat. It is generally agreed that dehydration is detrimental to the organism if it is permitted to reach the point of depletion of tissue fluids. The maintenance of proper water and salt balance are most important during treatment in a cabinet but it rarely presents any difficult problem during the reactions to typhoid shock. In other words, the metabolic effects as manifested by changes in blood chemistry are much more mild and physical exhaustion rarely occurs by this method.

Hyperthermia induced by typhoid vaccine excels in safety, simplicity, and economy. The treatment can be given either in the home or in the hospital. While it is of considerable advantage to carry out the therapy in a hospital with a private nurse in attendance, an intelligent mother can chart the temperature readings at half hour intervals during the period of high fever. Furthermore, the necessary equipment for

giving the vaccine is very simple—a 10 cc. syringe and needle, a small amount of sterile normal saline solution, and a bottle of typhoid or combined typhoid and paratyphoid vaccine. In contrast to this method, the apparatus for cabinet hyperthermia is rather elaborate and expensive. Likewise, artificial fever cannot be given by infra-red heat or by electromagnetic induction without the constant, watchful care of a well-trained assistant.

The simple method of giving typhoid vaccine as advocated by Howard has been the most satisfactory in our experience. In a modified form, we have employed the following routine:

In an adult, the first dose is 25 million organisms diluted in 10 cc. of normal saline solution at room temperature. The suspension of organisms is injected slowly into a vein of the forearm. While the chill may appear in one-half hour, the reaction may not occur until three hours have passed. The maximum rise of temperature from this initial dose may reach 104° or 105° F., although often it will reach only 103.5° F. In many instances, there is a fall from this high point in an hour and this is followed by a secondary rise of lesser degree, then the fever gradually subsides to normal within 24 to 36 hours. After the temperature has remained within the normal range for 24 hours, a second dose of vaccine, double in amount, is given. Following this dose of 50 million organisms, the chill and febrile response is usually more prompt—within an hour in most instances, and the temperature peak may be somewhat lower than in the first reaction. A secondary rise of fever is seldom experienced and the temperature may reach normal in 8 to 12 hours. Succeeding doses of the vaccine are doubled each time, that is, 100 million for the third dose, 200 million for the fourth, and so on. With the use of this method of administration, it is always important to withhold the injection until the temperature has been normal or nearly normal for 24 hours.

A review of our cases shows that the maximum therapeutic results are reached after six or seven injections. Rarely has it been necessary to produce a greater number of chills although in our earlier studies we did produce as many as 18 reactions without harmful effects. In children from 8 to 15 years of age, the initial dose is approximately 15 million bacilli. These youngsters tolerate the reactions very well. If it is desired to obtain a greater febrile reaction in robust adults, instead of using the method of Howard, a second dose of vaccine of equal strength may be given shortly after the first dose as soon as the temperature begins to rise in the first steep curve. Usually this does not prolong the febrile reaction time beyond that obtained with a single injection. Likewise, the end results seem to be no better.

The curves in charts 1, 2, 3, and 4 illustrate some characteristic

temperature reactions and charts 5 and 6 show temperature curves during hospitalization.

The results of therapeutic typhoid shock may be difficult to evaluate, particularly when other forms of treatment are carried out simultaneously. Likewise, a differentiation must be made between the immediate effects of the artificial fever while the patient is in the hospital and the late results a year or more after the patient has returned to his home. It is evident that well supervised, institutional care will modify the picture a great deal. It is easy for one to become overenthusiastic about any particular form of therapy when the patient is hospitalized and to forget that proper rest, diet, fluids, elimination, physiotherapy, and nursing care may deserve the greater credit for the improvement or the recovery. Likewise, the importance of the psychic effect on the patient must not be discounted. When a man who is suffering with a chronic illness is treated so that he experiences a real chill and fever, he is then certain that at last something is really being done to combat his illness. While this physical experience is good for the patient's emotional state, it should not be permitted to warp one's professional judgment.

Taking all these factors into consideration, we believe that in properly selected cases the use of typhoid shock is of value. The results in a few representative cases are shown in table 1. These

TABLE I

Disease	*Number of Cases*	*Satisfactory Results*		*Unknown Results*	*Unsatisfactory Results*
		Immediate	*Late*		
Acute rheumatic fever (acute endocarditis 1 case)	3	3	2	1	0
Chorea	7	6	4	2	1
Acute encephalitis	5	3	3	0	2
Thrombo-angiitis obliterans	4	2	2	0	2
Chronic rheumatoid arthritis	40	27 (67.5%)	22 (62.8%)	5	13 (32.5%)
Controls—without shock	20	11 (55%)	12 (60%)	0	8 (40%)

are consecutive cases taken from our files and they are considered without prejudice. In the ten cases of acute rheumatic fever and chorea, the immediate results were good in nine instances. Acutely swollen and painful joints subsided after two or three febrile reactions and no bad effects were observed in the one case of active rheumatic endocarditis. The patients with Sydenham's chorea were relieved of

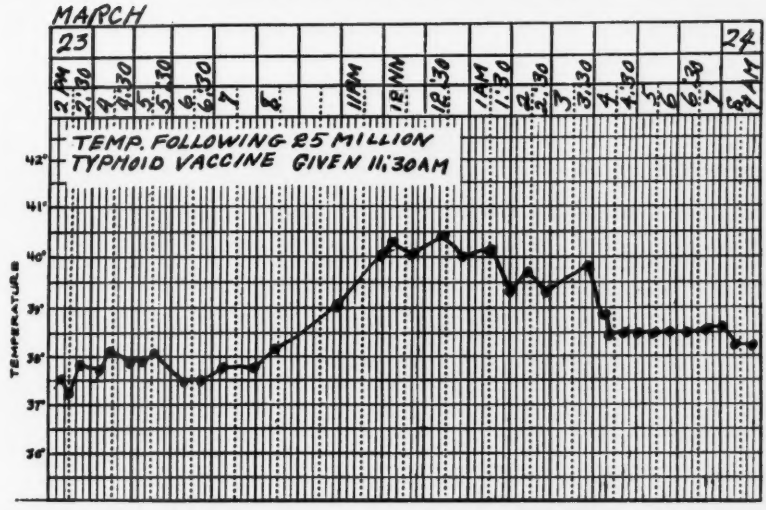

CHART 1: Temperature at half hourly intervals following administration of 25 million typhoid bacilli.

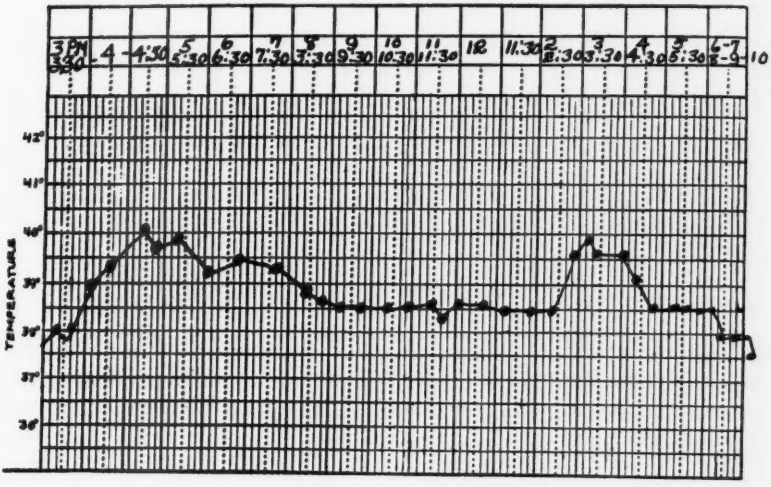

CHART 2: Temperature at half hourly intervals following administration of 50 million typhoid bacilli.

the violent and purposeless muscular movements after the third chill in all but one instance. In this case no improvement was noted either in the early or late observations. Subsequent observations on these nine patients over a period of a year or more showed no recurrence of symptoms although all the patients with arthritis and four of those

with chorea had experienced one or more attacks previous to treatment. It is evident that the period of observation is too short to justify final conclusions, but the immediate results in all except one were most satisfactory.

A group of five patients with acute manifestations of epidemic encephalitis were treated with intravenous typhoid vaccine in the hope that the resulting acute febrile reaction might mobilize intracellular

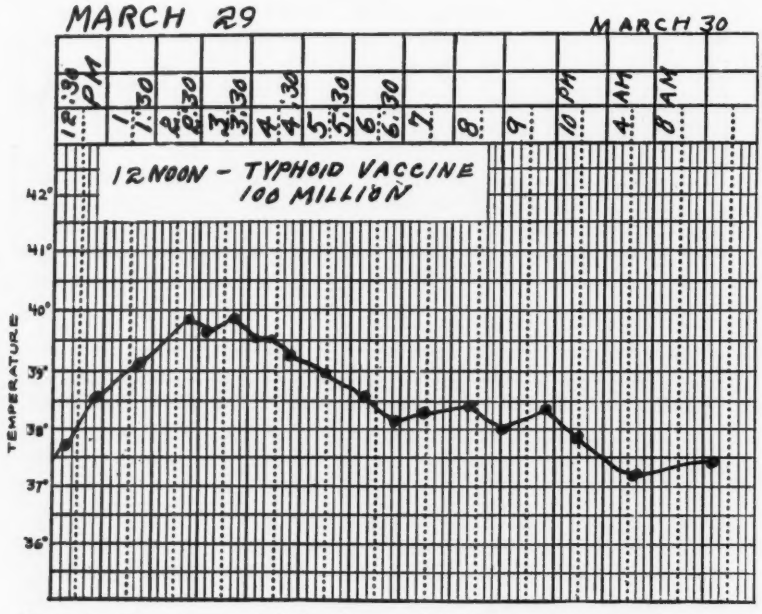

CHART 3: Temperature at half hourly intervals following administration of 100 million typhoid bacilli.

defense to the virus. At the present time the nature of the virus substance is not definitely settled. Whether it is a chemical substance or an ultramicroscopic organism is still a subject for research. Specific vaccines are not available and the value of therapy with salicylates, arsenic, iodides, or other medicinal substances is questionable. When given early in the disease, reactions to protein shock appear to be of definite value. In three of five patients in whom the symptoms had existed for five days, three and one-half weeks, and four months respectively, the immediate improvement following the reaction was very definite. None of these individuals had shown the late manifestations of the disease such as parkinsonism or oculogyric crises. In the two patients who were not helped, advanced parkinsonism had already developed and these symptoms were not affected by treatment.

Our experience with therapeutic typhoid shock in four cases of thrombo-angiitis obliterans was encouraging in two patients and disappointing in two others. If the collateral circulation is susceptible to improvement by vasodilatation, the treatment is of value and can be administered in one course or repeated at intervals of several weeks. It is difficult for one to predict just how good the response will be prior to a therapeutic trial. It is obvious that this measure alone

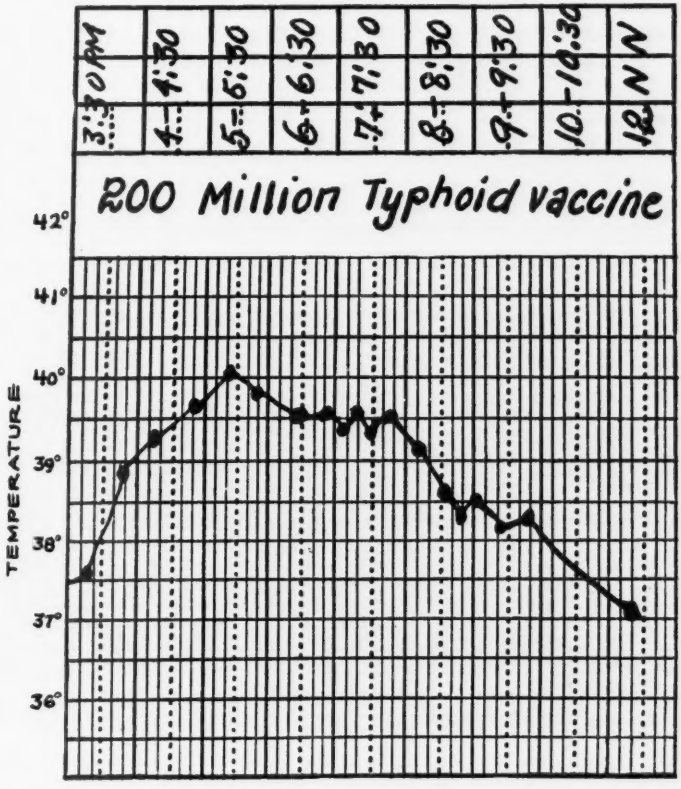

CHART 4: Temperature at half hourly intervals following administration of 200 million typhoid bacilli.

will not cure Buerger's disease. However, when improved peripheral blood flow does occur, there is certain to be an amelioration of pain and some healing of the trophic lesions. It is obvious that no benefit can accrue if the arteries and arterioles are so seriously damaged that there is impairment of blood flow from widespread thrombosis, both in the main and collateral channels. In every case, even if the treatment does not produce therapeutic improvement, it does have con-

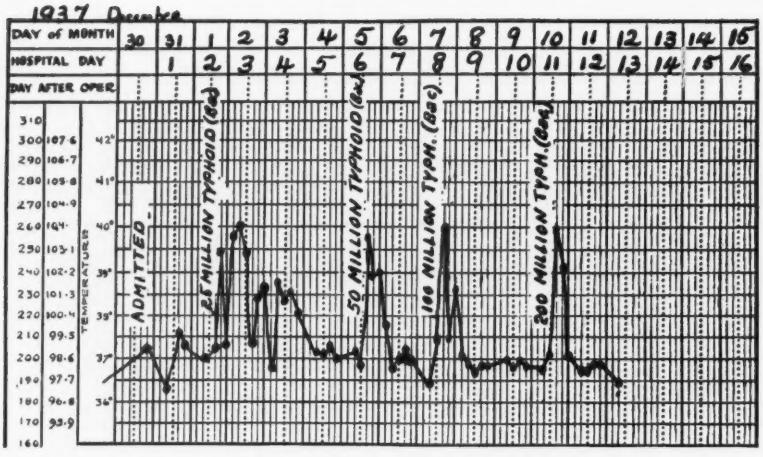

CHART 5: Daily record of temperature during administration of typhoid vaccine.

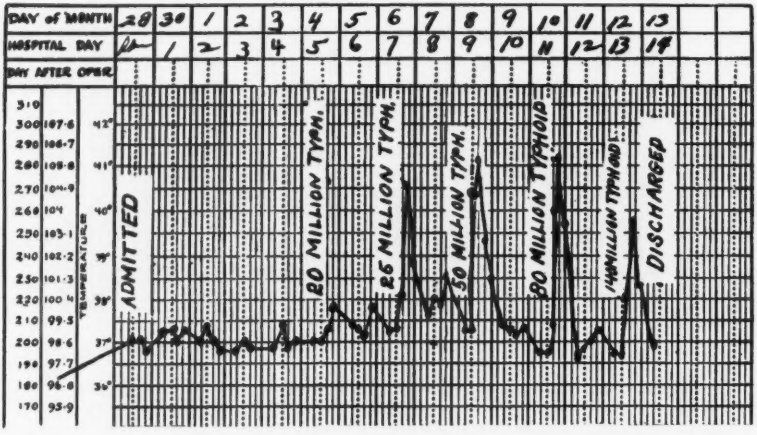

CHART 6: Daily record of temperature during administration of typhoid vaccine.

siderable prognostic value. If the hyperthermia fails, we are certain that the only other treatment of value consists of general tonic measures and hygienic care. Neither fever nor any other form of treatment can protect the patient from the possible necessity of amputation at a later date.

Any attempt to determine the value of nonspecific protein shock in the treatment of chronic rheumatoid arthritis presents many difficulties. If one is familiar with the modern conception of this disease, it will be realized that no single method of therapy, whether it be artificial

fever, streptococcus vaccine, diets, vitamins, glandular products, physiotherapy, removal of infected foci, or any of the magical cures advocated in pharmaceutical pamphlets will restore the patient to normal health. Excellent discussions of this serious and disabling disease will be found in modern monographs and textbooks. A most interesting summary of the problem of chronic arthritis is contained in the "Rheumatism Primer" prepared and printed by the Subcommittee of the American Committee for the Control of Rheumatism. This excellent monograph emphasizes the fact that chronic rheumatoid arthritis is a general disease of the body and not a local disease of the joints. We employed shock therapy in the hope that the cellular reactions would improve the general circulation and metabolism. During the hospital period of a month or more, a careful diagnostic survey was made and when we discovered anemia, a low metabolic rate, foci of infection, faulty diet, poor elimination, gastric achlorhydria, or any other organic or functional abnormality, corrective measures were instituted. In these patients, hyperthermia has served to give considerable relief from pain in the joints and general muscular aching. After a course of chills and fever, the majority of the individuals have been able to rest and sleep better, very often the joint swelling has diminished or disappeared, and the pain has largely subsided. In a series of 40 cases, we found that immediate improvement followed the bouts of fever in 67.5 per cent of the patients. However, in a control series of 20 cases, immediate good results were produced by bed rest, local physiotherapy, and general measures in 55 per cent. These results are not very impressive and certainly do not make a strong case for fever therapy. This is further emphasized by the late follow-up. After a year or more, it was found that 62.8 per cent of those who had taken typhoid shock as well as general treatment had remained improved; while in the control patients who did not receive fever, 60 per cent remained improved. These late results are almost equal and show that any benefit from shock therapy is temporary. However, it has value in its ability to make the patient comfortable and improve his morale. In general, he is more cooperative and desires to know more about his illness when he realizes that an earnest effort is being made to help him get well.

Chills produced by typhoid vaccine have been employed in various special fields of medicine to improve local circulation and stimulate the general metabolism of the cells. In ophthalmology, one or more chills may be used in chronic inflammatory disease of the eye, such as resistant forms of conjunctivitis or as an aid in combatting postoperative infections. Likewise, one or two chills prior to the removal of a foreign body from the eyeball may allay hyperemia due to local irritation. Vitreous exudate seems to undergo absorption more rapidly

after fever reactions and the resulting opacities may be decidedly less than in untreated cases.

Many lesions of the skin respond well to fever therapy. In erythema nodosum, chronic urticaria, resistant secondary lues, tinea sycosis, and even in psoriasis, the improvement is usually rapid. However, it cannot be expected that the underlying condition will be cured by this method alone. It is a good therapeutic adjunct to other forms of medication and may change resistant cases to those that will respond to ordinary measures.

Formerly, we employed typhoid shock in many urological conditions but at present we are using the cabinet hyperthermia as a satisfactory method for the treatment of gonorrheal infections, including acute urethritis, prostatitis, seminal vesiculitis, epididymitis, and above all, gonorrheal arthritis. In these, there is no doubt but that cabinet fever therapy is far superior to any other treatment. It acts as a specific in the cure of the various forms of the diseases noted above.

Patients who are suffering from diabetes, cardiorenal disease, advanced arteriosclerosis, myocardial insufficiency, and angina pectoris should not be given fever therapy without full realization of the possible dangerous consequences of this procedure.

Disease states that are accompanied by febrile reactions can be treated safely by protein shock. While the complete answer to the problem of fever therapy is not at hand, we believe that therapy by typhoid shock, while nonspecific, is of value in many disorders of the body that do not respond to ordinary measures. Likewise, our experience in the use of the method outlined in this paper has been gratifying.

MALOCCLUSION AS A CAUSE OF PAIN IN THE TEMPOROMANDIBULAR JOINT

C. A. Resch, D.D.S.

At the present time, considerable importance is attached to abnormalities of the temporomandibular joint, especially as they apply to the symptoms of pain referred over the branches of the fifth nerve. These symptoms include tinnitus, deafness, a chronic catarrhal otitis media, glossodynia, xerostomia, eczema of the auditory canal, and vertigo. It is a moot question how often these symptoms are referable to abnormality of this joint.

In the last two decades, considerable investigation has been carried out on the problem of malocclusion from the anatomical, clinical, and histological standpoints. Wright[1] in 1920 and Monson[2] in 1921 presented papers showing the rôle of adjustment of the dental bite in the treatment of deafness. Kirk[3] demonstrated the anthropological basis of these findings and produced mathematical proof that trauma of the ear could result from the stress of abnormal dental occlusion. Prentiss[4], Maves[5], Goodfriend[6], Cryer[7], and most recently Costen[8] have contributed to the establishment of a syndrome associated with temporomandibular dyscrasia.

Joint disease in the absence of symptoms is a well-recognized entity. Redfern in 1850 first observed this and stated that joint diseases at times progress until complete destruction of the cartilage has resulted without the patient being aware of any abnormality. On the other hand, these same types of disease may cause violent pain and irritation. The symptoms supposed to indicate disease in the cartilage are closely allied with those produced by affections of the bone. Politzer in 1878 observed that the anterior wall of the bony auditory meatus was often pierced, showing a round or oval orifice.

A detailed discussion of the anatomy and symptomatology of this articular dyscrasia will not be presented here but an attempt will be made to correlate the existing dental and clinical findings with abnormalities of the joints and to discuss briefly the problems involved in dental reconstruction.

Goodfriend[6] has estimated the incidence of abnormalities of occlusion in a group of men from 20 to 30 years of age to be approximately 55 per cent. In cases of loss of hearing, 11.4 per cent occurred in the presence of normal occlusion, while with abnormalities of occlusion this figure was increased to 13.3 per cent. Costen[8] has stated that symptoms of disease of the ear predominate in edentulous mouths. When pain is present, the cases fall into the class of malocclusion re-

sulting from loss of molar support on one side only or malocclusion sufficient to produce destruction of one or both temporomandibular articulations.

In a survey of the histories of 854 patients of varying ages seen in the Dental Department, it was found that 725, or 84 per cent, showed a definite masticating deficiency with loss of one or more of the posterior teeth and no replacement. This may be of more significance in the general ill health of the patient than in temporomandibular abnormalities only. Of these 725 patients, 406 or 56 per cent showed clinical evidence of loss of vertical dimension as evidenced by too closely approximating posterior ridges and fanned out, markedly traumatized, or abraided anterior teeth. Of this group of 406 patients, 55 per cent had clinical signs of abnormalities of the joint, 14 per cent of which were of such a nature that the subjective symptoms had caused the patient to seek relief. The remaining 41 per cent were classified as passive, the patient being unaware of the existence of clinical evidence of joint dyscrasia and experiencing no real discomfort. The symptoms were usually mild subluxation or a cracking sensation, tinnitus, or slight tenderness to pressure. Of the remainder of the 406 patients with deficient masticating function and loss of vertical dimension of the jaws, 181 or 44 per cent were apparently free from symptoms.

In the next grouping, 319 or 37 per cent of the total number of patients showed deficiency in masticating function with no clinical evidence of loss of vertical relationship of the jaws. It was found that 30 per cent of this group exhibited temporomandibular dyscrasias of which 3.7 per cent were active, 26 per cent passive, and 70 per cent showed no symptoms.

A third group consisting of 48 patients, or 5.6 per cent of the total, were found to have no deficiency in masticating function but some evidence of loss of vertical dimension. Many in this group were patients whose missing teeth had been replaced by mechanical measures—so-called cases of compensation. Of this group, 33.3 per cent had symptoms of temporomandibular abnormality, 4 per cent of which were classified as acute, 29 per cent as passive, and 66-2/3 per cent produced no apparent symptoms.

A fourth group in which there was no deficiency in masticating function and no loss of vertical dimension was found to consist of 7.9 per cent of the total (68 patients). Three patients or 4.4 per cent had active symptoms. Two of these were cases of compensation, 12 or 17 per cent had passive symptoms, and 78.6 per cent had no symptoms.

A fifth group was comprised of 13 patients exhibiting no deficiency of masticating function and no loss of vertical dimension, but with

marked malocclusion of the teeth as evidenced by malposition and improper cusp digitation. Of these, 53 per cent had symptoms of temporomandibular abnormality and 46 per cent had no symptoms.

A summary of these figures shows that they agree with Goodfriend's observation[6] that the incidence of abnormality of the temporomandibular joint increases with the rising incidence of abnormality of occlusion. Loss of teeth with subsequent loss of vertical dimension as well as malocclusion tends to produce these abnormalities. It may be said that approximately 50 of every 100 individuals suffer demonstrable loss of vertical dimension with deficiency in masticating function. Of these 50, more than one-half will exhibit abnormality of the temporomandibular joint to some degree and, of these, 14 will seek medical or dental relief.

In the presence of malocclusion, regardless of the fact that there is no existing deficiency of masticating function and that there may or may not be loss of vertical dimension, the chances are about equal that there will be some evidence of a temporomandibular abnormality. In this group, there are many patients who state that the condition has apparently been of lifetime duration. To these, however, the condition is usually one of persistent annoyance and not painful sequence. It has been my observation, and this agrees with that of Costen[8], that those patients with edentulous mouths complain more of symptoms with reference to the ear while those with pain usually have missing teeth on one side only, loss of vertical dimension, and malocclusion.

Dental reconstruction in these cases is not so simple as it would seem. For this reason, proper verification of the diagnosis, based on clinical restorative measures, is relatively infrequent. Dr. Costen[8] has stated that *failure* to relieve the symptoms has been *consistent* when, in the effort to open the bite, the condyle was brought to rest upon the articular eminence, impinging on the part of both bony structures where erosion most often occurs. The mechanical aspects are quite difficult. It is still a matter of trial and error to correct the true vertical dimension of the jaws with the construction of splints to the posterior areas, using the relation of the front teeth as a guide.

No consideration, so far as I am aware, has been given to the great distress occasioned to the patient on the first few days after the splints have been inserted for the purpose of increasing the vertical plane. This discomfort is similar to that caused by a high filling which everyone has experienced at some time.

Then too, when the posterior teeth are missing, extensive stress placed on this region causes in some cases a more rapid resorption of bone in this area which is particularly true where teeth were lost through pyorrhea alveolaris. Most prosthodontists feel that these cases of

posterior extension where the anterior teeth are present should be managed in the following manner. The anterior teeth should be built up into proper balance occlusion to afford a resting position and to equalize the stress. This necessitates crowns made of baked porcelain on each of the anterior teeth or the alternative of sacrificing either the upper or lower teeth, preferably both, so that the replacements may be fixed in equilibrium. Thus, the masticating function is distributed equally over a wider surface to prevent any abnormal resorption to a particular area which will produce not only a recurrence of joint symptoms but ill-adaptation of the appliances with malfunction of those appliances. With the loss of teeth and subsequent drifting and tipping of the adjacent teeth, an excessive pressure on these latter teeth often causes a localized pain, due to the fact that the stress is not delivered along the long axis of the tooth. This is a factor that must be taken into consideration in the reconstruction process of the mouth. Again, many of the tipped teeth contain deep restorations approximating the pulp and may contain a degenerating pulp. The question of whether removal or retention is indicated is often most difficult to decide. These are the problems confronting the dentist. To work them out successfully demands careful study, a degree of experimentation, a material cost, and patience. The time consumed, the effort, and the mechanical ingenuity of the operator must be compensated for. The successful termination of such cases is, therefore, an expensive and prolonged procedure. The patient must return frequently for rechecks, adjustments, and repairs. On the part of the patient it requires complete cooperation and infinite patience. After the hurdle of the invariable period of discomfort has been passed, if the optimum restoration has been secured, reflex pains and other symptoms are definitely relieved. Recently, a patient was seen who stated that he could not keep the lower denture out of the mouth for any length of time because of the almost immediate return of neuralgia associated with a left temporomandibular articulation. Often, I have been told that a patient wears his appliances at night because of the comfort they give for, if taken out, an uncomfortable night will surely follow.

In summarizing, Goodfriend states that the causes of articular dysfunction are many, the order of their importance being (1) loss and excessive wear of the teeth; (2) malocclusion and anomalies of bite; (3) disequalibrium of masticating stresses; (4) direct injury to the joint; (5) inflammation of the teeth, tonsils, and ears; (6) nutritional disturbances; and (7) systemic disease.

The rationale of treatment is based on the fact that the mandibular articulation will undergo functional adaptation which is well illustrated during eruption of a tooth and recognized by Wolf's law. The treatment is essentially that of repositioning the mandible and reconstructing

the basic dental curve of occlusion or balance in order to establish a normal articular relationship to relieve intra-articular pressure and eliminate occlusal trauma. This should follow eradication of dental infection and irritants. Rest of the repositioned joint is essential for minimizing the postoperative discomfort, and certainly systemic factors must not be overlooked. All this embodies the utmost patience and cooperation from the patient, considerable expense, and a long duration of time.

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TETRALOGY OF FALLOT

Report of a Case

H. Scott Van Ordstrand, M.D.

Abbott[1] has classified congenital defects of the cardiovascular system in three principal groups: (1) the a-cyanotic group, (2) the group of cases in which there is an arteriovenous shunt with possible transient cyanosis due to reversal of flow through the defect, and (3) the cyanotic group (morbus caeruleus) in which cyanosis is permanently present.

The tetralogy of Fallot is the most common member of the cyanotic group. The tetrad consists of a defect of the ventricular septum, pulmonary or infundibular stenosis, dextroposition of the aorta, and hypertrophy of the right ventricle. The aorta arises from both ventricles above a large, smooth-walled defect in the upper part of the interventricular septum. Maude Abbott[2] found the average duration of life in 83 cases to be 12¾ years. White[3] has reported a case in which the patient lived to the age of 59 years and 9 months.

Report of Case

The patient, a 15 year old boy, was admitted to the clinic on December 23, 1937, with the chief complaints of dyspnea on slight exertion, poor appetite, constipation, and abdominal pain. A blue baby at birth, he had always had a poor appetite and had taken a very inadequate diet. Since birth there had been dyspnea on slight exertion and cyanosis had been present constantly. In the 8 months before his admission, there had been several episodes of bleeding from the mouth and into the subcutaneous tissues, and for 2 weeks he had complained of pain in the lower part of the abdomen and increased constipation.

The general physical examination revealed a slender, undernourished boy with dusky bluish skin and deeply cyanotic mucous membranes. The tongue showed marked geographic ridging. The thorax was increased in the anteroposterior diameter and was somewhat pear-shaped with limited diaphragmatic excursion. The lungs were clear on percussion and auscultation. The area of relative cardiac dulness extended to the midclavicular line in the fifth intercostal space. The heart rhythm was regular and the rate 92 per minute. A palpable systolic thrill was present in the third left interspace adjacent to the sternum. The mitral first sound and the pulmonic second were accentuated. A harsh systolic murmur was present in the second and third left intercostal spaces adjacent to the sternum, and, in addition, a diastolic murmur was present over the pulmonary area when the patient was in the recumbent position only. The liver and spleen could not be felt. There was marked clubbing of the fingers and toes (Figs. 1 and 2), and slight pitting edema

FIGURE 1: Photograph showing clubbing of fingers.

FIGURE 2: Photograph showing clubbing of toes.

was present in the lower legs. A few petechiae were present about the umbilicus. A tourniquet test did not bring out additional petechiae.

Roentgenograms of the chest revealed a boot-shaped heart and increased hilar lung shadows. The electrocardiogram showed sinus tachycardia with a rate of 110 per minute. Right axis deviation was present. Roentgen examination of the colon gave normal findings.

The red blood cells numbered 7,750,000 per c.mm. The hemoglobin content was 136 per cent. The white blood cell count was 9,300 per c.mm. The bleeding and coagulation time and the platelet count were normal.

The urine had a specific gravity of 1.016 and contained four plus albumin. Microscopic examination revealed many hyaline and granular casts. The Wassermann and Kahn reactions of the blood were negative. The cevitamic acid content of the blood plasma was 0.129 mg. per 100 cc. (normal 0.9 mg.).

Discussion

This case illustrates all the significant features of the cyanotic type of congenital heart disease. A high degree of cyanosis was present constantly and was due principally to the fact that the dextroposed aorta received blood from both the right and left ventricles. There was clubbing of the fingers and toes. Examination of the blood revealed an increase in the number of red blood cells and in the hemoglobin content. This represents an attempt on the part of the hematopoietic system to compensate for the deficient oxygenation of the tissues.

In view of the dietary history and the reduction in the cevitamic acid content of the blood plasma, it was concluded that the hemorrhagic manifestations were the result of deficiency disease, particularly of vitamin C. The abdominal distress was considered to be due to an irritable colon, the symptoms of which had been enhanced by the long continued use of irritating cathartics.

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The Frank E. Bunts Institute

The Frank E. Bunts Institute will present a course in "Diseases of the Endocrine Glands" which will be given on Monday, Tuesday, and Wednesday, April 18, 19, and 20, 1938.

* * *

The following program will be presented:

DISEASES OF THE ENDOCRINE GLANDS

Monday, April 18, 1938

8:30 A. M.— 9:00 A. M.	Registration	
9:00 A. M.	Introduction	George Crile, Sr., M. D.
9:00 A. M.—10:30 A. M.	Differential Diagnosis of Diseases of the Thyroid Gland	E. P. McCullagh, M. D.
10:30 A. M.—11:30 A. M.	An Analysis of the End Results of 25,740 Operations on the Thyroid Gland	George Crile, Sr., M. D.
11:30 A. M.—12:15 P. M.	Malignancy of the Thyroid Gland	Allen Graham, M. D.
12:30 P. M.— 1:30 P. M.	Luncheon	
1:30 P. M.— 2:00 P. M.	Exhibits The Biochemistry of Hyperthyroidism—Practical Value of Tests	D. R. McCullagh, Ph.D.
2:00 P. M.— 3:00 P. M.	The Cardiovascular Complications of Thyroid Disease	A. C. Ernstene, M. D.
3:00 P. M.— 4:00 P. M.	Surgical Indications in Disease of the Thyroid Gland	R. S. Dinsmore, M. D.
4:00 P. M.— 5:00 P. M.	The Psychoses Associated with Thyroid Disease	Louis J. Karnosh, M. D.
6:30 P. M.	Dinner	
8:15 P. M.	Frank E. Bunts Lecture, "Testicular Neoplasms and Gonadotropic Hormone."	Herbert M. Evans, M. D. Professor of Anatomy and Morris Herzstein Professor of Biology, University of California Medical School.

Tuesday, April 19, 1938

9:00 A. M.— 9:45 A. M.	Management of Severe Hyperthyroidism and the Bad Risk Patient	George Crile, Jr., M. D.
9:45 A. M.—10:30 A. M.	The Ocular Complications of Thyroid Disease	A. D. Ruedemann, M. D.
10:30 A. M.—11:30 A. M.	Management of Functional Menstrual Disorders	E. P. McCullagh, M. D.
11:30 A. M.—12:15 P. M.	Hypothyroidism—Signs, Symptoms, and Treatment	C. L. Hartsock, M. D.
12:30 P. M.— 1:30 P. M.	Luncheon	
1:30 P. M.— 3:00 P. M.	The Management of Diabetes	E. P. McCullagh, M. D.
3:00 P. M.— 3:45 P. M.	Influence of the Endocrine Glands on Benign Hypertrophy of the Prostate and Impotency and Sterility in the Male	W. E. Lower, M. D.
3:45 P. M.— 4:15 P. M.	Sterility in Women	T. E. Jones, M. D.
4:15 P. M.— 5:15 P. M.	The Roentgen Aspects of Endocrine Diagnosis	B. H. Nichols, M. D.
6:30 P. M.	Dinner	
8:15 P. M.	The Evolution of the Glandular System—Its Meaning in the Etiology and Treatment of Certain Diseases	George Crile, Sr., M. D.

Wednesday, April 20, 1938

9:00 A. M.— 9:45 A. M.	Management of Undescended Testicles	C. C. Higgins, M. D.
9:45 A. M.—10:30 A. M.	The Diagnosis and Treatment of Prostatic Disease	W. J. Engel, M. D.
10:30 A. M.—11:30 A. M.	Lesions of the Pituitary Gland—Diagnosis and Treatment	W. J. Gardner, M. D.
11:30 A. M.—12:00 Noon	Obesity	E. P. McCullagh, M. D.
12:30 P. M.— 1:30 P. M.	Luncheon	
1:30 P. M.— 2:00 P. M.	Exhibits Demonstration of the Value of Assays (laboratory) in Endocrine Diagnosis	W. K. Cuyler, M. A.

Wednesday, April 20, 1938 (Continued)

SYMPOSIUM ON LESIONS OF THE BREAST

2:00 P. M.— 2:45 P. M. Clinical Significance of a Lump in the Breast ..... George Crile, Jr., M. D.

2:45 P. M.— 3:30 P. M. Points in Surgery of the Breast with Clinical End Results ..... R. S. Dinsmore, M. D.

3:30 P. M.— 4:15 P. M. The Pathological Changes of Lesions of the Breast ..... Allen Graham, M. D.

4:15 P. M.— 5:00 P. M. Roentgen Therapy in Cancer of the Breast ..... U. V. Portmann, M. D.

REGISTRATION BLANK

....., 1938

THE FRANK E. BUNTS INSTITUTE
Cleveland Clinic
Cleveland, Ohio

Gentlemen:

Please register me for the course in "Diseases of the Endocrine Glands" which is to be given April 18, 19, and 20, 1938.

I am enclosing a check for $5.00 and the remainder of the fee, $5.00, will be paid on registration, April 18th.

Name .....

Address .....

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Medical School from Which Graduated

Note: Checks should be made payable to The Frank E. Bunts Institute and sent to A. D. Ruedemann, M. D., Cleveland Clinic, Cleveland, Ohio.

Exhibits

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Sellar and Parasellar Tumors ..... Dr. W. James Gardner

Transurethral Resection of the Prostate ..... Dr. W. J. Engel

Medical Treatment of Prostatic Hypertrophy ..... Dr. William E. Lower

Roentgen Changes in Endocrine Diseases ..... Dr. B. H. Nichols and Dr. Joseph C. Root

Cardiovascular Complications of Hyperthyroidism ..... Dr. A. C. Ernstene

Evolution of Thyroid Disease ..... Dr. George Crile and Dr. George Crile, Jr.

Technic of Thyroid Surgery ..... Dr. George Crile, Jr.

Carcinoma of the Breast ..... Dr. Allen Graham and Dr. George Crile, Jr.

Diabetes ..... Dr. E. P. McCullagh

Obesity ..... Dr. E. P. McCullagh

Clinical Results of Testis Hormone Assays ..... Dr. E. P. McCullagh